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Essays on Economics of Career Concerns and Financial Markets

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Career Concerns and Investment Maturity in Mutual Funds*

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Abstract

An important puzzle in financial economics is why fund managers invest in short-maturity assets when they could obtain larger profits in assets with longer maturity. This work provides an explanation to this fact based on labor contracts signed between institutional investors and fund managers. Using a career concern setup, we examine how the optimal contract design, in the presence of both explicit and implicit incentives, affects the fund manager's decisions on investment horizons. A numerical analysis characterizes situations in which young (old) managers prefer short-maturity (long-maturity) positions. However, when including multi-task analysis, we find that career concerned managers are bolder and also prefer assets with long maturity.

Key words. Contract theory; career concerns; financial equilibrium; investment maturity

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1 Introduction

One of the most puzzling results in financial economics is why fund managers invest in short-maturity assets even though they could obtain larger profits in assets with longer maturity.¹ This puzzle may become particularly important as long as the large recurrence of this phenomenon may eventually affect the equilibrium prices in financial markets. In this paper, we propose an explanation for this puzzling behavior based mainly upon two facts. First, during the last decades institutional investors have increased dramatically their participation in the financial system.² Consequently, it is reasonable to conjecture that labor contracts signed by this class of investors and their managers may play an important role as determinants of the stock prices' dynamics. Second, there is a recent evidence supporting the fact that young managers exhibit a clear bias in favor of short-maturity securities. This suggests the usefulness of considering a theoretical framework in which decisions on investment maturity may be driven by an age-based agent heterogeneity.

We combine these two facts in a career concern-based model in which the *institutional investor* (the principal) designs an optimal contract that considers both *explicit* and *implicit* incentives of two class of *funds managers* (the agents): young and old traders. While the former is a trader who cares about how the current performance affect his future compensation, the latter is a trader without career concerns. The major prediction of our model is that, under certain conditions, this optimal contract leads the young (old) managers to prefer short-maturity (long-maturity) investments. Under the career concerns set-up, the intuition behind this result is quite simple. Since the history of old traders' performance have already been revealed, the principal's prediction about their ability is better than that made when they are young. This implies that a young trader has to show good returns in the short-run in order to improve the principal's belief about his ability, and to increase both the probability of being retained and his future compensation. As a consequence, he ends up selecting short-maturity assets less profitable than the long-maturity ones.

The main implication of our model is that this investment maturity bias may eventually explain some episodes of stock price overreactions observed in practice.³ This means therefore that our setting is able to shed light on a very relevant financial puzzle by characterizing an interesting and so far unexplored link between both the *labor market* and the *financial market*.

¹See Chevalier and Ellison (1999).

²For instance, in the New York Stock Exchange, the percentage of outstanding corporate equity held by institutional investors has increased from 7,2% in 1950 to 49,8% in 2002 (NYSE Factbook 2003).

³See Dasgupta and Prat (2005).

Furthermore, we extend our model by performing a sensibility analysis of the results when we include both *career-risk concerns* - how the agent's current performance affects the *variability* of his future compensation - and *multitask analysis*. Under the assumption that implicit incentives are strong and the presence of an information collection effort, we observe that both young and old managers prefer to invest in long-maturity assets. In addition, both kind of traders choose the same contract when the ratio of variances of long-maturity to short-maturity assets increases. The intuition of this result is that the higher the career-risk concerns, the smaller the information collection effort level. As a consequence, the mutual fund's owner may find optimal to increase the manager's pay-for-performance sensitivity, leading young managers to adopt bolder positions in favor of securities with long maturity.

Our work is in connection with plenty of literature, both theoretical and applied one. For instance, one of the works that supports empirically the fund managers' preferences for short-maturity positions is that of Chevalier and Ellison (1999). They find that young fund managers are more risk averse in selecting their portfolios - by choosing short-maturity securities - than the old ones, even though in this way, they obtain less profits by comparison with what they could get holding more mature assets. Furthermore, their results suggest a *nonlinear* relationship between managerial turnover and mutual fund's performance. This means that for young traders the managerial turnover is more performance-sensitive than the old ones, which leads to a U-shape in the relationship between managerial turnover and trader's performance. Chevalier and Ellison explain this fact through the differences in the career concerns among them. In this way, as well as Dutta and Reichelsen (2003) and Sabac (2006), our work tries to explain theoretically this empirical evidence through the differences in the *pay-for-performance sensitivity* between young and old managers.

A large literature in economics and finance have studied the determinants of the executive compensation contracts. Nevertheless, only a minority part has focused on how the implicit incentives of the fund managers affect the design of these contracts, and through this, the investment maturity decisions. The exceptions are Gibbons and Murphy (1992), Meyer and Vickers (1997), Dutta and Reichelsen (2003), Christensen et al. (2005) and Sabac (2006). All of these works study how optimal contracts including manager's career concerns can explain the aforementioned nonlinear managerial turnover-performance relationship for young and old managers. In general, this literature analyzes dynamic settings with short-term contracts based on the career concerns model developed by Holmström (1999). For instance, Gibbons and Murphy (1992) assume that the principal's bargaining power is null, i.e. that the principal's expected surplus is zero in equilibrium. On the contrary, Meyer and Vickers (1997) develop a

model in which the bargaining power is on the principal's hands, i.e. in equilibrium the agent's certainty equivalent is zero at each contracting date. Another difference between both works is that while the former shows the equivalence between short-term contracts and renegotiation-proof contracts, the latter proves that the agent's effort in equilibrium and the total surplus are independent of the bargaining power. Trying to encompass these models, Sabac (2006) characterizes the optimal short-term contract which satisfies renegotiation-proof including long-term actions, when today actions affect not only today but also tomorrow performance. Unlike all this literature, we attempt to explain how the fund manager's investment maturity decisions are determined by the design of the optimal labor contracts regarding *both* short and long-term actions.

Finally, our paper is also related to some corporate finance literature. In particular, Von Thadden (1995) constructs a dynamic model with asymmetric information between risk neutral investors and firms. Under his framework, it makes impossible to implement long-term projects which are more profitable. This work then tries to explain why some myopic lenders could induce their borrowers - an entrepreneur firm - to invest in short-term projects. However, unlike our setting, Von Thadden takes *only* into account the risk-neutral agent's *explicit* incentives but *not* his *implicit* incentives.

The paper is organized as follows. Section 2 sets up a career concern model that includes investment maturity decisions in the context of an institutional investor, and characterizes the optimal contract. Section 3 presents a numerical analysis that shows situations in which fund managers with (without) career concern prefer assets with short (long) maturity. In the next section, we examine the robustness of these results when including human capital risk and multitask analysis. Finally, Section 5 concludes and discusses other possible extensions.

2 The Model

The output performance process

Consider an agency model in which the principal is the mutual fund's owner and the agent corresponds to the trader, who for simplicity we assume that is the mutual fund manager as well. The trader works for two periods. At the beginning of period 1, the trader selects his investment portfolio. That is, he invests an amount of money I . At each period t , the output performance of this process corresponds to the variation of the value of such an investments (i.e. the return) denoted by z_t . This is given by an additive formulation of the trader's ability (η), the trader's non-negative effort (a_t)

and a noise (δ_t^H) , as follows

$$z_t \equiv \Delta I_t = \eta + a_t + \delta_t^H, \quad (2.1)$$

where η is normally distributed with mean m_0 and variance σ_0^2 .

Similarly, we assume that the noise δ_t^H is normally distributed with mean $\mu_{\delta_t^H}$ and variance $\sigma_{\delta^H}^2$. The index H denotes the horizon of the investment so that $H = S$ ($= L$) means that the trader selects short-maturity (long-maturity) securities. Thus, the agent decides not only the effort level, but also the horizon of his investment.

Following Von Thadden (1995), we assume that the short-maturity investment gives more benefits in the first-period than the long-maturity one. However, regarding the total gains for the two periods, long-maturity assets are more profitable than short-maturity ones. Moreover, we suppose that the long-maturity investment is more risky than the short-term one. These ideas are formalized by means of the next assumptions:

- (A1) $\mu_{\delta_1^S} > \mu_{\delta_1^L}$,
- (A2) $\mu_{\delta_2^S} < \mu_{\delta_2^L}$,
- (A3) $\mu_{\delta_1^S} + \gamma\mu_{\delta_2^S} < \mu_{\delta_1^L} + \gamma\mu_{\delta_2^L}$, and
- (A4) $\sigma_{\delta^S}^2 < \sigma_{\delta^L}^2$,

where $\gamma \in (0, 1)$ represents a discount factor.

In addition, we adopt some standard assumptions in the career concerns literature. First, independence both among δ_t^H 's, and with ability η , is supposed to hold. Second, we assume that the true ability of the trader is unknown even for himself. As a consequence, the principal adjusts her beliefs on the mean and the variance of this ability based only upon the information revealed through the investment returns observed in the previous period.

The payoff functions

The trader is risk-averse with the following exponential utility function:

$$U(w_1, w_2; a_1, a_2) = -\exp\left(-r \left\{ \sum_{t=1}^2 \gamma^{t-1} [w_t - g(a_t)] \right\}\right)$$

where w_t is the agent's wage, $g(\cdot)$ measures the disutility of effort and r corresponds to the absolute risk-aversion index. We assume that $g(\cdot)$ is convex and satisfies $g'(0) = 0$, $g'(\infty) = \infty$ and $g''' \geq 0$.

We consider two kind of agents: young traders and old traders, While the former have career concerns, the latter do not care about their future careers.

The fund's owner is risk-neutral with a profit function given by⁴

$$\pi(z_1, z_2; w_1, w_2) = \sum_{t=1}^2 \gamma^{t-1} (z_t - w_t).$$

⁴We normalize the price of output to unity.

Type of Employment Contracts

We assume throughout the paper that all employment contracts offered by fund's owners to traders correspond to linear contracts of the form $w_t(z_t) = c_t + b_t z_t$. On the one side, c_t , the fixed part, represents the insurance wage since traders are risk-averse. On the other side, b_t , the variable component, is called the pay-for-performance sensitivity.

Within this linear formulation, we specify two different types of labor contracts: contingent and non-contingent contracts, as follows.

(1) *Contingent contract with termination after bad news (CC)*. This arrangement consists of two one-period labor contracts, one for each period. However, if the first-period results are less than certain threshold \underline{z} , the whole contract finishes and is not renewed to the second period.⁵ In this sense, it is a contingent contract because the second-period contract is exerted only under the condition $z_1 > \underline{z}$. According to this contract, the trader can only select short-maturity assets.

(2) *Non-contingent contract with continuation after bad news (NC)*. This is a two-period labor contract in which no matter what happens to the first-period output. In this sense, it is non-contingent because the continuation of the contract to the second-period does not depend on the first-period results. According to this contract, the trader can only select long-maturity assets.⁶

Therefore, each labor contract allows the trader to invest in assets with different maturity. Thus, the risk-expected return profiles associated to contingent and non-contingent contracts differ. One motivation for this assumption comes from the fact that employment arrangements very similar to these two kind of contracts are observed in the real world. This is the case of institutional investors which must offer different labor contracts to its traders because they face customers with different risk-return profiles and investment horizons. Thus, while some investors looks for high returns in the short-term (who put their savings in hedge funds, money management companies, and aggressive mutual funds), others are willing to wait for larger gains in the long-term (who put their savings in insurance companies, pension fund companies, and private equity firms).

Timing of the contracting game

We assume that all the bargaining power is on agent's hands. The timing of this game depends on the type of labor contract chosen by the trader (and thereby, on the horizon investment selected by him).

⁵For instance, \underline{z} could be equal zero. Thus, after bad results, the contract is not renegotiated.

⁶Gibbons and Murphy (1992) demonstrate a renegotiation proof for this kind of contracts. First, they characterize a two short-term labor contracts. Then, they construct an optimal long-term labor contract offering a different explicit incentives in each period.

In the case of contingent labor contracts, the timing is as follows. At the beginning of the first period, prospective employers simultaneously offer the trader single-period linear wage contracts $w_1(z_1)$ as defined before and he chooses the most attractive one. The trader selects a short-maturity asset and exerts a level of effort. At the end of the first period, the first-period wage is paid. At the same time, the principal and the market observe the output z_1 . At the beginning of period 2, if they observe good results ($z_1 > \underline{z}$), they simultaneously offer the trader another single-period linear wage contract $w_2(z_2)$. After that, the trader exerts a new level of effort. At the end of the second period, investment returns are known, wages are paid, and the game is over. In contrast, if bad news on the first-period result are revealed ($z_1 < \underline{z}$), no new contract for the second-period is offered to him by any principal.

In the case of non-contingent labor contracts, the timing is very similar with two exceptions. First, the trader selects instead a long-maturity asset. Second, the second-period contract $w_2(z_2)$ is *always* offered no matter what happens to the investment return in the previous period.

Characterization of the Optimal Contract

Given the compensation contracts described above, the trader's expected utility is a function of the first and second period effort as follows

$$-E \{ \exp(-r [c_1 + b_1 z_1 - g(a_1)]) - r\gamma [c_2(z_1) + b_2 z_2 - g(a_2)] \}. \quad (2.2)$$

In order to solve this problem, consider the Subperfect Nash Equilibrium (SPNE) concept. Consequently, we apply backward induction so that we begin characterizing the second-period effort problem.

Second-period contract. The characterization of the second-period contract assumes implicitly that the second-period result is larger than the threshold \underline{z} in the case of the contingent contract. From the perspective of the second-period trader, after the first-period effort a_1 and the horizon investment H have been chosen, and z_1 has been observed, his effort choice problem is given by

$$\max_{a_2} -E \{ \exp(-r [c_2 + b_2 z_2 - g(a_2)]) | z_1 \}. \quad (2.3)$$

Hence, $a_2^*(b_2)$, the optimal second-period agent's effort choice satisfies

$$g'(a_2) = b_2 \quad (2.4)$$

Note that we assume that all the bargaining power is on the agents' hands. As a consequence, competition among prospective second-period employers implies that the contract the trader accepts for the second period must generate zero expected profits. Therefore, the principal's zero profit condition at period 2 is given by

$$\pi_2 = E \{ z_2 | z_1 \} - [c_2^*(z_1, b_2) + b_2 E \{ z_2 | z_1 \}] = 0. \quad (2.5)$$

Hence, and according to (2.1), the optimal fixed part of the second-period wage can be obtained using the following condition:

$$\begin{aligned} c_2(z_1, b_2) &= (1 - b_2)E\{z_2|z_1\} \\ &= (1 - b_2)\left[E\{\eta|z_1\} + a_2^*(b_2) + \mu_{\delta_2^H}\right] \end{aligned} \quad (2.6)$$

Using De Groot (1970), it can be stated that the conditional distribution of η given the observed first-period output z_1 is Normal with mean

$$E\{\eta|z_1\} \equiv m_1(z_1, \hat{a}_1) = \frac{\sigma_{\delta^H}^2(m_0 + \mu_{\delta_1^H}) + \sigma_0^2(z_1 - \hat{a}_1)}{\sigma_0^2 + \sigma_{\delta^H}^2} \quad (2.7)$$

and variance

$$V\{\eta|z_1\} \equiv \sigma_1^2 = \frac{\sigma_0^2\sigma_{\delta^H}^2}{\sigma_0^2 + \sigma_{\delta^H}^2}, \quad (2.8)$$

where \hat{a}_1 represents the market's conjecture about the first-period effort. Let $\Sigma_{z_2|z_1}^{2H} \equiv \sigma_1^2 + \sigma_{\delta^H}^2$, the conditional variance of $\eta + \delta_2^H$ given the observed first-period output z_1 .

Applying the first-order approach, we can substitute (2.4) and (2.6) into (2.3) to restate the effort choice problem. Accordingly, for an arbitrary b_2 and given the first-period output z_1 , (2.3) can be rewritten as:

$$\max_{b_2} -E\{\exp(-r[c_2^*(z_1, b_2) + b_2 z_2 - g(a_2^*(b_2))])|z_1\}.$$

Using (2.7) and (2.8), this problem becomes

$$\max_{b_2} m_1(z_1, \hat{a}_1) + a_2^*(b_2) + \mu_{\delta_2^H} - g(a_2^*(b_2)) - 1/2r \left[b_2^2 \Sigma_{z_2|z_1}^{2H} \right].$$

Now, using the first order conditions of this optimization problem, we get the following expression for b_2 :

$$b_2^C = \frac{1}{\left[1 + r \Sigma_{z_2|z_1}^{2H} g''(a_2)\right]}, \quad (2.9)$$

where $C = NC$ and CC . Note from (2.9) that the second-period explicit incentives depend on the conditional variance of the second-period output $\Sigma_{z_2|z_1}^{2H}$. This means that the pay for performance is sensitive to the type of employment contract, and thereby, to the horizon investment.

First-period contract. Now, we analyze separately contingent and non-contingent labor arrangements. We start finding out what is the optimal contract in the first case. Given the optimal second-period contract derived above, the trader's incentive problem at the first-period is to choose a_1 to maximize:

$$-E\{\exp(-r[c_1 + b_1 z_1 - g(a_1)] - r\gamma[c_2(z_1, b_2^*) + b_2^* z_2 - g(a_2^*(b_2^*))])\}. \quad (2.10)$$

From the first-order condition of this problem, we obtain

$$\begin{aligned} g'(a_1) &= b_1 + \gamma \frac{\partial c_2(z_1, b_2^*)}{\partial a_1} \\ &\equiv B_1. \end{aligned} \quad (2.11)$$

So far, we have taken \hat{a}_1 as given. Thus, the last expression characterizes implicitly the trader's best response to the market's second-period conjecture about the first-period effort, \hat{a}_1 . Since equation (2.11) does not depend on \hat{a}_1 , in equilibrium the market's conjecture coincides with the optimal first period effort. Therefore, the equilibrium conjecture is

$$\hat{a}_1 = a_1^*(b_1).$$

As was established before, the principal's expected profit must be zero in each period. Hence, we have that

$$\begin{aligned} c_1(b_1) &= (1 - b_1)E\{z_1\} \\ &= (1 - b_1)(m_0 + a_1^*(b_1) + \mu_{\delta^H}) \end{aligned} \quad (2.12)$$

Notice that the terms inside the two exponential functions of expression (2.10) correspond to variables normally distributed. Thus, we can apply the property of the log-normal random variables.⁷ Then, substituting $a_1^*(b_1)$ and $c_1(b_1)$ into (2.10) yields the first-period trader's expected utility for an arbitrary b_1 :

$$- \exp(-r[\mu_{z_1} - g(a_1^*(b_1))]) - r\gamma[\mu_{z_2} - g(a_2^*(b_2))]) - \frac{1}{2}r^2[(B_1 + \gamma b_2^*)^2 \Sigma_{z_1}^{2H} - 2B_1\gamma b_2^* \sigma_{\delta^H}^2]$$

with $\mu_{z_1} = E(z_1)$, $\mu_{z_2} = E(z_2)$ and $\Sigma_{z_1}^{2H} = V(z_1)$. The first-order condition of this problem with respect to b_1 gives us the following expression:

$$b_1^C = \underbrace{\frac{1}{1 + r \sum_{z_1}^{2H} g''(a_1^*(b_1))}}_{\text{Noise reduction effect}} - \underbrace{\gamma(1 - b_2^*) \frac{\sigma_0^2}{\sigma_0^2 + \sigma_{\delta}^{2H}}}_{\text{Career concern effect}} - \underbrace{\frac{r\gamma b_2^* \sigma_0^2 g''(a_1^*(b_1))}{1 + r \sum_{z_1}^{2H} g''(a_1^*(b_1))}}_{\text{Career risk effect}} \quad (2.13)$$

where $C = NC, CC$.

We observe three class of effects on the pay-for-performance component: (i) a noise reduction effect, (ii) a career concerns effect, and (iii) a career risk effect. The noise reduction effect means that the higher the conditional variance of output, the smaller the variable compensation. In other words, the trader prefers less noise in the investment process. The career concerns effect reflects the substitutability between explicit and implicit incentives. Thus, the higher the career concern-based incentives measured by the second term of the r.h.s. of equation (2.13), the smaller the pay-for performance.

⁷These terms are essentially linear combinations of z_1 , and z_2 , which are normally distributed.

Lastly, the career risk effect formalizes the idea that a risk-averse trader wants to be compensated for high variances in his performance due to low realizations of ability.

It is worthy to note how differences in labor contracts, and so differences in investment horizons, affect this substitutability between explicit and implicit incentives. Therefore, we observe different linear wages depending on contingency or non-contingency of employment contracts, and thereby, on the maturity (long vs. short) of the assets.⁸

The relevance of the risk aversion assumption can be stated from the following simple analysis. It is easy to verify from (2.13) that under risk neutrality ($r = 0$), the first-period explicit incentives of both contingent and non-contingent labor contracts becomes

$$b_1^{*C} = 1 - \left[\gamma \left(1 - b_2^{*C} \right) \left(\frac{\sigma_0^2}{\sigma_0^2 + \sigma_{\delta H}^2} \right) \right].$$

Since now from (2.9) $b_2^{*C} = 1$, it follows that $b_1^{*C} = 1$ for $C = CC, NC$. Therefore, this illustrates that in order to explain how the presence of these two class of contracts affects the trader's investment horizon decision, one *must* assume risk aversion.

Old Trader's Optimal Contracts

As was mentioned before, while the young agents cares about their future career, the old ones has no such reputational concerns. We formalize this difference in our setup by assuming that ability of the old trader has already been fully revealed, and thus, its variance σ_0^2 is equal to zero. As a result, it yields the following optimal explicit incentives for old traders at the second-period

$$b_2^C = \frac{1}{\left[1 + r\sigma_{\delta H}^2 g''(a_2) \right]},$$

and at the first-period

$$b_1^C = \frac{1}{1 + r\sigma_{\delta H}^2 g''(a_1^*(b_1))}$$

for $C = CC, NC$. The last expression shows clearly that optimal contracts for old traders only exhibit a noise reduction effect, but neither career concern nor risk career effect come to play a role. The absence of reputational concerns then implies that all incentives are driven by the pay for performance component, and no substitutability between explicit and implicit incentives emerges.

⁸In the next section we endogeneize the career-risk concern (or human capital risk concerns), which also affects this substitutability.

3 Investment Maturity Decision: Numerical Results

The main purpose of this paper is to characterize conditions under which traders (young and old) prefer to invest in either long or short maturity assets. To this end, we perform a comparison in terms of the surplus obtained by these agents from the two class of labor contracts analyzed in our setting: non-contingent (NC) and contingent (CC) contracts.

Let S_Y^C and S_O^C be the surplus obtained from the labor contract C by young and old traders, respectively. Also, let us define surplus differences DY and DO as $DY = S_Y^{CC} - S_Y^{NC}$ and $DO = S_O^{CC} - S_O^{NC}$, respectively. A positive surplus difference evaluated at the optimal contract then indicates that a trader (young or old) prefers to sign a contingent employment contract instead of a non-contingent one. Equivalently, this means that he also prefers to invest in a short-maturity assets instead of a long-maturity ones.

In order to assess the trader's surplus from both labor contracts, one need to choose realistic numerical values for all model parameters. Ravin (2000) developed a set of parameter values that approximates decisions that resemble real-world investment choices by assuming a CARA utility function. The specific parameter values employed are the following.

First, we assume the following preference parameters: a risk aversion parameter $r = .05$ and a discount factor $\gamma = .9$. Second, our analysis has shown that optimal contracts (and so traders surplus differences) depend crucially on both expected return and riskiness of investments - for both long and short maturity ones -. Based upon U.S. historical data, we suppose that the long-maturity asset is normally distributed with mean return 6.4% and standard deviation 10%.⁹ In contrast, we assume that the short-maturity asset follows a normal distribution with mean return 0.5% and standard deviation of 0.3%.

Given these parameters, we construct the *variance ratio* KV as follows

$$KV = \frac{\sigma_{\delta^L}^2}{\sigma_{\delta^S}^2},$$

and KM , the following *mean return ratio*

$$KM = \frac{\mu_{\delta_1^L} + \gamma\mu_{\delta_2^L}}{\mu_{\delta_1^S} + \gamma\mu_{\delta_2^S}}.$$

Since the bargaining power is on agent's hands, the trader surplus is the expected CARA utility function evaluated at the optimal contract characterized in the previous section. Table 1 shows the effects of both the variance ratio and the mean return ratio on surplus differences of old and young traders.

⁹Ravin (2000) works with a standard deviation of 20%. Our assumption is thus more conservative.

TABLE 1
Surplus difference between non-contingent and contingent labor contract

case	KM = 12	KM = 13	KM = 14
KV = 20	DY = 0.00135	DY = 0.00110	DY = 0.00085
	DO = -0.00007	DO = -0.00031	DO = -0.00055
KV = 40	DY = 0.00189	DY = 0.00165	DY = 0.00140
	DO = -0.00090	DO = -0.00112	DO = -0.00136
KV = 60	DY = 0.00234	DY = 0.00209	DY = 0.00184
	DO = -0.00169	DO = -0.00233	DO = -0.00216

KM = ratio between long-maturity and short-maturity expected return.

KV = ratio between long-maturity and short-maturity variance.

DY=Young manager's surplus difference.

DO=Old manager's surplus difference.

We observe that under a variance ratio sufficiently high ($KV \geq 20$), young traders prefer a contingent labor contract instead of a non-contingent one. This result follows from the substitutability between explicit and implicit incentives in our model. Then, the higher the career concerns they face, the smaller the non-contingent labor contract explicit incentives. This implies that they are more conservative in their investments, and thereby, choose short-maturity assets.

Moreover, the higher the long-maturity asset variance, the higher the preference by young traders for contingent labor contracts, and so, for short-maturity assets. Since managers concern about his future job opportunities, they care about career-risk concerns. This last effect implies less non-contingent explicit incentives again. Thus, the higher the preference to invest in less risky assets.

On the contrary, since old traders do not have career concerns, they only care about explicit incentives. Thus, there is no substitutability between explicit and implicit incentives. As a result, they hold riskier assets. Furthermore, the higher the long-maturity asset variance - the higher KV -, the higher the preference for non-contingent labor contracts, and thus, for long-maturity assets.

It is important to note that these numerical results account for one of the main stylized facts described by Chevalier and Ellison (1999) for the U.S. mutual fund market. In fact, they present evidence that suggests that old managers prefer assets with longer maturity than those assets selected by the young ones. Interestingly, Chevalier and Ellison also attributes these differences in investment maturity to reputational concerns.

4 Extensions

4.1 Including Human Capital Risk

In the previous section we take into account reputation concerns, i.e. how the manager's current performance affects the level of his future compensation. However, the agent's current performance can also affect the variability of his prospective compensation, what we call career-risk concerns or human capital risk.¹⁰ To study this effect, in this section we introduce two innovations to the baseline model: (i) different degrees of career concern, and (ii) an additional class of effort called *information effort*.

The main implication of this extension is that we can observe *complementarity* between implicit and explicit incentives instead of substitutability as we have seen before. Following Chen and Jiang (2008), we introduce a multitask analysis and generalize the last career concern setup. A numerical analysis points out that now both old and young fund managers prefer to invest assets with long maturity.

4.1.1 Degree of Career Concerns

In order to implement this extension, we introduce a correlation in the ability process. Now, the ability or productivity measure follows a normal stationary autoregressive process with one lag, i.e., AR(1). In this way, η_t is correlated over time through the next system:

$$\begin{aligned}\eta_1 &= \theta \\ \eta_2 &= \rho\theta + \sqrt{1 - \rho^2}\epsilon.\end{aligned}$$

As in previous section, we assume both the principal and the agent share the common prior that θ is normal distributed with variance σ_θ . For simplicity, we assume throughout this section that $E(\theta) = m_0 = 0$. Further, ϵ is a zero mean gaussian normal process independent of θ , with variance equal to σ_θ . Therefore, η_1 and η_2 have the same unconditional variance equal to σ_θ^2 .

Notice that ρ plays an important role in this process because when $\rho = 1$, we are in the baseline model in which career concerns are maximum. In addition, ρ captures the degree of persistence of the agent's career concerns since a higher ρ implies higher sensitivity of the agent's future compensation to current-period performance. Furthermore, when we model the second period as a reduced-form representation of all future periods, the career concerns parameter, ρ , captures the tenure effect. The smaller the expected tenure implies the lower correlation between the agent's ability

¹⁰See Mukherjee (2005) and Chen and Jiang (2004).

and the firm's future productivity. Then, by introducing $\rho \in [0, 1]$ we analyze the relationship between explicit incentives and the degree of the agent's career concerns.

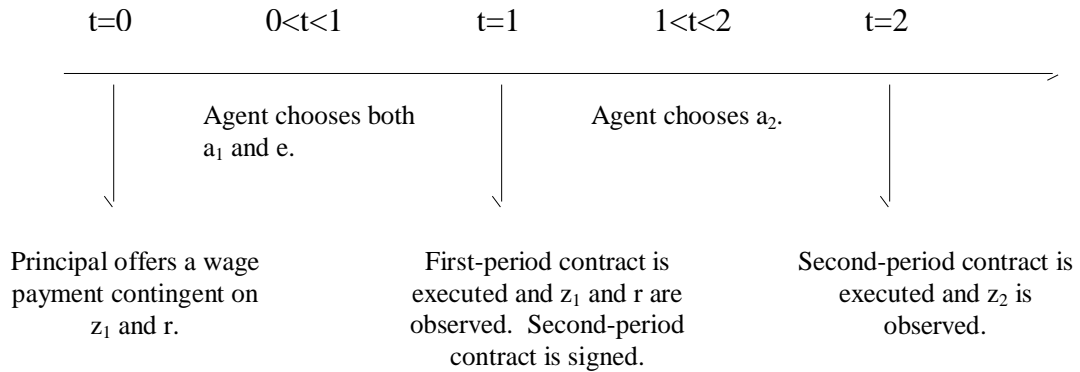
4.1.2 Multitask and Career-Risk Concerns

Following Chen and Jiang (2004), we introduce a new class of effort: *information collection effort*, $e \in [0, 1]$. In this way, the trader can exert another type of effort in order to produce a publicly verifiable report, r , about his ability η . There exists some linear relationship between the report and the ability: $r = \eta_1 + \Delta$, where Δ is a zero mean normal innovation term orthogonal to η_1 with variance $\frac{(1-e)}{e}\sigma_\delta$. This variance implies that the higher information collection effort, the higher the precision of the report to forecast η_1 . We assume that the principal only uses the report r for contracting goals.

As in our baseline model, we assume that the contract takes the linear form $w_t = c_t + b_t z_t + \lambda_t r$ where c_t, b_t and λ_t are constants. Notice that we introduce r as a variable that can help the principal to forecast the next period ability. In this way, the wage system can be rewritten as:

$$\begin{aligned} w_1 &= c_1 + b_1 z_1 + \lambda_1 r \\ w_2 &= c_2(r, z_1) + b_2 z_2 \end{aligned}$$

We assume that e is not contractible, i.e. it is chosen by the agent after the contract is offered to him and is non-verifiable. The timeline of this game is described by Figure 1.



In order to solve the model, we consider again the Subperfect-Nash equilibrium concept. Then, using backward induction, at the beginning of the second-period, z_1 and r are observed. Afterwards, the trader chooses a_1 and e . Finally, the principal chooses c_2 and b_2 to maximize the expected profit subject to the agent's participation and the

incentive compatibility constraint. Then, the second period effort choice problem is:

$$\max_{a_2} -E \{ \exp -r (w_2 - g(a_2)) \mid r, z_1 \}.$$

Thus, $a_2^*(b_2)$ satisfies $g'(a_2) = b_2$. As in the previous section, normalizing the price of output to unity and using zero profit condition, we obtain:

$$\begin{aligned} c_2^*(z_1, r, b_2) &= (1 - b_2) E \{ z_2 \mid z_1, r \} \\ &= (1 - b_2) \left[\rho E \{ \theta \mid z_1, r \} + a_2^*(b_2) + \mu_{\delta^H}^H \right], \end{aligned} \quad (4.1)$$

with

$$\begin{aligned} E(\theta \mid z_1, r) &\equiv m_1(z_1, r, \hat{a}_1) \\ &= \frac{(1 - e)\sigma_0^2(z_1 - a_1) + e\sigma_{\delta^H}^2 r + (1 - e)\sigma_{\delta^H}^2 \mu_1^H}{(1 - e)\sigma_0^2 + \sigma_{\delta^H}^2} \end{aligned} \quad (4.2)$$

and variance

$$\begin{aligned} V(\theta \mid z_1, r) &\equiv \sigma_1^2 \\ &= \frac{(1 - e)\sigma_0^2\sigma_{\delta^H}^2}{(1 - e)\sigma_0^2 + \sigma_{\delta^H}^2}. \end{aligned} \quad (4.3)$$

In this way, we observe how the reputation concerns, ρ , and career-risk concerns, e , affect the agent's fixed wage in the second period. Now, replacing $c_2^*(z_1, b_2)$ and $a_2^*(b_2)$ in the agent's maximization problem, we obtain

$$b_2^* = \frac{1}{\left[1 + r\Sigma_2^{2H} g''(a_2) \right]}, \quad (4.4)$$

with $\Sigma_2^{2H} = \sigma_1^2 + \sigma_{\delta^H}^2$. We observe a positive implicit relationship between information collection effort and second-period explicit incentives through total conditional variance.

Given the optimal second-period contract derived above, the trader's first-period incentive problem is to choose a_1 to maximize the following problem:

$$-E \{ \exp(-r [c_1 + b_1 z_1 + \lambda_1 r - g(a_1)] - r\gamma [c_2^*(z_1, b_2) + b_2^* z_2 - g(a_2^*(b_2))]) \}.$$

Then, we get

$$\begin{aligned} g'(a_1) &= b_1 + \gamma \frac{\partial c_2^*(z_1, b_2)}{\partial a_1} \\ &= b_1 + \gamma \left\{ (1 - b_2) \left[\frac{\rho(1 - e)\sigma_0^2}{(1 - e)\sigma_0^2 + \sigma_{\delta^H}^2} \right] \right\} \\ &\equiv B_1. \end{aligned} \quad (4.5)$$

So far we have taken \hat{a}_1 as given. Thus, the last expression characterizes the worker's best response to the market's second-period conjecture about first-period effort, \hat{a}_1 . Since equation (4.5) does not depend on \hat{a}_1 , in equilibrium, the market's conjecture coincides with the optimal first period effort.

Therefore, the equilibrium conjecture is:

$$\hat{a}_1 = a_1^*(b_1).$$

As we established before, the fund owner's expected profits must be zero in each period. Hence, assuming $a_0 = 0$,

$$\begin{aligned} c_1^*(b_1) &= (1 - b_1)E\{z_1\} \\ &= (1 - b_1)[m_0 + a_1^*(b_1) + \mu_1^H] + \lambda_1 E(r). \end{aligned} \quad (4.6)$$

Since $E(r) = 0$, we then obtain the same expression as our baseline model.

Substituting $a_1^*(b_1)$ and $c_1^*(b_1)$ in the first-period maximization problem yields the following first-period expected utility for an arbitrary b_1 :

$$\begin{aligned} & - \exp(-r[m_0 + a_1^*(b_1) + \mu_1^H - g(a_1^*(b_1))]) - r\gamma[\rho m_0 + a_2^*(b_2) + \alpha a_1^* + \mu_2^H - g(a_2^*(b_2))] \\ & - (1/2)r^2\gamma \left[(B_1 + \gamma b_2^*)^2 \Sigma_1^{2H} - 2B_1\gamma b_2^* \sigma_{\delta^H}^2 + (\lambda + \gamma b_2)^2 \sigma_0^2 + \lambda^2 \left[\frac{(1-e)}{e} \right]^2 \sigma_{\delta^H}^2 - \gamma^2 b_2^2 \sigma_0^2 \right] \end{aligned}$$

with $\Sigma_1^{2H} = \sigma_0^2 + \sigma_{\delta^H}^2$.

From the first order condition with respect to b_1 we get

$$b_1^{*C} = \frac{1}{1 + r\Sigma_1^{2H}g''(a_1(b_1))} - \gamma \left(1 - b_2^{*C}\right) \frac{\rho(1-e)\sigma_0^2}{(1-e)\sigma_0^2 + \sigma_{\delta^H}^2} - \frac{r\gamma b_2^{*C} \sigma_0^2 g''(a_1^*(b_1))}{1 + r\Sigma_1^{2H}g''(a_1(b_1))} \quad (4.7)$$

with $C = CC, NC$.

4.2 Numerical Analysis

To assess the trader's surplus from contingent and non-contingent labor contracts, we need to choose realistic numerical values for all model parameters. We assume λ and ρ equals to 0.5.¹¹ In order to observe a degree of substitutability between explicit and implicit incentives, we assume an information effort level $e = .1$. The rest of parameters are the same as in our baseline model. The following table presents the surplus difference between both class of contracts for traders with and without career concerns.

¹¹When we only consider different levels of career concerns, we obtain the same results as in our baseline model. This means that our previous analysis is robust to intertemporal correlations in the ability process. Only when we include Chen and Jiang's modifications about different kind of effort - multitask analysis - we observe changes in our baseline model results.

TABLE 2
Surplus difference between non-contingent and contingent labor contract

case	KM = 12	KM = 13	KM = 14
KV = 20	DY = -0,11061	DY = -0,11083	DY = -0,11106
	DO = -0,00801	DO = -0,00825	DO = -0,00849
KV = 40	DY = -0,11949	DY = -0,11972	DY = -0,11994
	DO = -0,01624	DO = -0,01647	DO = -0,01671
KV = 60	DY = -0,12822	DY = -0,12844	DY = -0,12866
	DO = -0,02439	DO = -0,02463	DO = -0,02486

KM = ratio between long-maturity and short-maturity expected return.

KV = ratio between long-maturity and short-maturity variance.

DY=Young manager's surplus difference.

DO=Old manager's surplus difference.

With degrees of career-concern and multitask analysis, we observe that both young and old managers prefer to invest in long-maturity assets, as $DO, DY < 0$. Moreover, both types of traders behave in the same way when the variance ratio increases. Thus, the higher the variance of long-maturity assets, the higher the preference to non-contingent labor contracts. The intuition of this result is that the higher the career-risk concerns, the smaller the information effort level. As a consequence, the mutual fund's owner may find optimal to increase the pay-for-performance sensitivity. All of this implies that young managers become bolder as they also follow investment strategies with long maturity.

5 Concluding Remarks

This paper addresses an important puzzle in financial economics: why fund managers invest in short-maturity assets even though they could obtain more profits by holding positions in securities with longer maturity. We provide an explanation to this phenomenon based on the labor contracts signed between institutional investors and their traders.

In particular, we examine how differences in the pay-for-performance's sensitivity of young and old traders affect their investment horizon decisions when career concerns are considered. In our framework, only young traders care about their career concerns. By analyzing the substitutability between explicit and implicit incentives contained in the optimal labor contracts, we then perform a numerical analysis showing that young (old) managers prefer short-maturity (long-maturity) positions. The higher the career concerns they face, the smaller the non-contingent labor contract explicit

incentives. This implies they are not bold in their investments, and thus, they choose short-maturity assets.

The intuition behind this result is as follows. Since the history of old traders' performance have already been revealed, the principal's prediction about their ability is better than that made on the young ones. As a consequence, young traders prefer contingent labor contracts that implicitly lead them to select assets with a higher mean return in the short run. This allows young traders to improve the principal's belief about his ability, and thus, increase both the chances of being retained and his second-period compensation. However, as short-maturity assets exhibit lower mean return than long-maturity ones in the long run, we eventually have a situation in which less profitable assets are selected. Interestingly, this prediction is consistent with the recent evidence found by empirical literature focused on the U.S. mutual fund market (Chevalier and Ellison, 1999).

Furthermore, we extend our model by performing a sensibility analysis of the results when we include both *career-risk concerns* - how the agent's current performance affects the variability of his future compensation - and multitask analysis. A numerical analysis suggests that traders with and without career concerns prefer a non-contingent labor contract. The intuition of this result is that the higher the career-risk concerns, the smaller the information effort level. Then, the mutual fund's owner may find optimal to increase the manager's pay-for-performance sensitivity. As a result, young managers become eventually bolder in their investment strategies.

Some extensions of this work may take into account other aspects of the optimal contracts: switching costs when traders decide to change the job; other kind of remunerations in order to know more about the trader's ability, for instance, stock options; and so on. Furthermore, it should be considered other classes of performance process which also imply differences in the pay-for-performance sensitivity between young and old managers. For instance, the variation of investments could follow a long memory process instead of a normal stationary AR(1) process, which is more closed to the empirical works in GDP time series.¹²

¹²Mayoral (2004) presents evidence that GNP per capita follows a long-memory process.

6 References

- CHEN AND JIANG (2004): Career Concerns and The Optimal Pay-for-Performance Sensitivity, Working Paper, Duke University.
- CHEVALIER, J., AND G. ELLISON (1999): Career Concerns of Mutual Fund Managers, *Quarterly Journal of Economics*, 114(2), 389-432.
- CHRISTENSEN, P., G. FELTHAM AND F. SABAC (2005): A Contracting Perspective on Earnings Quality, *Journal of Accounting and Economics*, 39, 265-294.
- DASGUPTA, A., AND A. PRAT (2005): Asset Price Dynamics When Traders Care About Reputation, Discussion Paper, CEPR.
- DUTTA, S., S. REICHELSTEIN (2003): Leading Indicator Variables, Performance Measurement and Long-Term versus Short-Term Contracts, *Journal of Accounting Research*, 41(5), 143-168.
- GIBBONS, R., AND K. MURPHY (1992): Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence, *Journal of Political Economy*, 100(3), 468-505.
- HOLMSTROM, B. (1999): Managerial Incentive Problems: A Dynamic Perspective, *Review of Economic Studies*, 66(1), 169-182.
- MAYORAL, L. (2006): Further Evidence on the Statistical Properties of Real GNP, Working Paper, Universitat Pompeu Fabra.
- MEYER, M., AND J. VICKERS (1997): Performance Comparisons and Dynamic Incentives, *Journal of Political Economy*, 105(3), 547-581.
- MUKHERJEE, A. (2005): Career concerns and Optimal Disclosure Policy, Working Paper, Northwestern University.
- RAVIN, M. (2000): Risk Aversion and Expected-utility Theorem: A Calibration Theorem, *Econometrica*, 68(5), 1281-1292.
- SABAC, F (2006): Learning and Managerial Horizons: Beyond Career Concerns, Working Paper, University of Alberta.
- VON THADDEN, E. (1995): Long-Term Contracts, Short-Term Investment and Monitoring, *The Review of Economic Studies*, 62(4), 557-575

Two-sided Career Concern and Financial Equilibrium*

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Abstract

This brief paper constructs a model of delegated portfolio management in which two agency relationships are characterized. First, a delegation process from investors to fund companies, and second, a delegation from fund companies to fund managers. Career concerns of both agents lead to a churning equilibrium in which uninformed managers trade noisily, and uninformed fund companies are willing to hire these uninformed managers. This equilibrium delivers non-fully informative prices and a positive and *high* trading volume. Our model then strengthens previous explanations to the trade puzzle, predicting an increasing trade activity as long as institutional investors with intense delegation play an increasing role in financial markets.

Key words. career concern; financial equilibrium; trade puzzle.

Journal of Economic Literature. Classification Number: D53, D86, G11, G12, G14, G23

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1 Introduction

One of the most remarkable puzzle in financial economics is the so-called *trade puzzle*. This puzzle concerns the inability of standard finance paradigm to account for (high) trade observed in financial markets under an environment with asymmetric information. Given the increasing presence of institutional ownership in financial markets during the last fifty years, new explanations to this phenomenon have strongly hinged on the features of this class of investors.¹

In particular, recent literature on financial economics has recognized the prominent role played by contracts signed by investors and fund companies. Among these works, that of Dasgupta and Prat (2006, [1]) provides an especially interesting framework that explains the puzzle trade based mainly upon two elements. First, they consider the agency problems that emerge when the investor delegates his portfolio management to the fund company. In addition, due to the no observation of the fund manager's ability, they study contracts with implicit incentives given by reputational or *career concerns*. This setting predicts that the presence of career concerns induces uniformed fund managers to *churn*, i.e. to trade even when they face a negative expected return.² Noise trade given by churning makes prices to be non-fully informative, which yields a positive trading volume in the asset market.

Dasgupta and Prat treat fund companies and fund managers as the same entity, abstracting then from any agency problem between them. However, as Chevalier and Ellison (1999, [2]) document, the lack of aligned incentives resulting from this delegation process may become very important to the portfolio strategies followed by fund managers. Accordingly, in this paper we extend the set-up of Dasgupta and Prat and study the effects that the additional delegation from fund companies to fund managers can generate on the financial market's equilibrium. Our main result points out that when the reputational costs of both fund companies and fund managers are also considered, the career concern-based explanation for the trade puzzle becomes strong. As a consequence, this paper accounts not only for the increasing trading activity observed in the financial markets during the last decades, but also for the relation of this phenomenon to the increasing participation of institutional investors with more portfolio management delegation inside them (Dow and Gorton 1997, [3]; Cuoko and Kanel 2001, [4]; Chevalier and Ellison 1997, [5], and 1999, [2]).

¹For instance, in the New York Stock Exchange, the percentage of outstanding corporate equity held by institutional investors has increased from 7,2% in 1950 to 49,8% in 2002 (NYSE Factbook 2003).

²Churning can be defined as to make the account of a client excessively active by frequent purchases and sales primarily in order to generate commissions.

This structure of this paper is as follows. Section 2 presents a model with two-sided career concerns contracts between fund companies and fund managers. The next section characterizes the churning equilibrium, and discusses its implications for the trade puzzle. Finally, Section 4 concludes. All the proofs are collected in the Appendix.

2 The Model

Consider a two-period economy. The market trades an Arrow security, which has liquidation value $v = 0$ or 1 with the same probability of occurrence. This value is revealed at time t and independent across periods. There are a large pool of ex-ante identical fund companies and fund managers³. All of them are risk-neutral.

In the first period, one of the fund companies is employed at random by the investor, a single risk-neutral principal. Likewise, this fund company may hire one fund managers and, if so, at the end of the first period she may decide to retain him, hire a challenger of average quality from the pool, or not to hire. Her decision is based on the net return obtained by the fund manager. In the same way, in period 2, the investor decides to renew the incumbent fund company or hire a new one as she can attempt to infer the ability of the fund company from the outcome of trading.

Therefore, in this environment, we observe two kind of principal-agent contracts: the first one between the investor and the fund company, and the second one between the fund company and the fund manager. In addition, both agency relationships are characterized by reputational or career concerns. This is because present actions taken by both fund companies and fund managers affect their chances of being retained, and thereby, their future compensations.

The fund company can be of two types: talented or untalented. This is represented by $\eta \in \{u, t\}$, with $\Pr(\eta = t) = \zeta$. Similarly, the fund manager can be of two types: good or bad, represented by $\theta \in \{b, g\}$ so that $\Pr(\theta = g) = \gamma$. Ex ante, all types are unknown to fund companies, fund managers and the investor, and are independent of v .

Fund managers interact with a large number of risk-neutral short-lived competitive uninformed market makers (hereafter traders). Half of them operate in $t = 1$, the other half operate in $t = 2$. Fund managers can issue market orders (a_t) to buy one unit of the asset ($a_t = 1$), to sell one unit ($a_t = 0$) or not to trade ($a_t = \emptyset$). The traders sets ask (p_t^a) and bid (p_t^b) prices equal to the expected value of v conditional on the observed order history. The bid-ask spread $p_t^a - p_t^b$ may be positive, with $p_t^a \in [\frac{1}{2}, 1]$

³Throughout the paper, we refer to the principal as she and the agent as he. Notice that the fund company is the agent in the relationship with the investor and the principal in the labor contract with the manager.

and $p_t^b \in [0, \frac{1}{2}]$. Since fund managers are free to choose one of the market makers at random, they are then subject to Bertrand competition. Moreover, for simplicity we assume that traders do not know whether they are in period 1 or 2.⁴

Before contracting, fund companies observe a signal τ on manager's type. Talented companies observe an informative signal that reveals the true type of the manager. In contrast, untalented companies have access to a noisy signal that does not improve their beliefs on the manager's type. Formally, we have that

$$\tau(\eta, \theta) = \begin{cases} \theta & \text{if } \eta = t \\ \emptyset & \text{if } \eta = u \end{cases}$$

Based upon this information, fund companies make a decision $e_t \in \{0, 1\}$, where $e_t = 1$ ($e_t = 0$) corresponds to hiring (not to hiring) the manager. Whereas untalented fund companies choose good (bad) fund managers with probability γ (with probability $1-\gamma$), talented fund companies *only* choose good fund managers.

The information structure of the fund manager is as follows. At time t a fund manager receives a signal s which can take three values, 0, 1, or \emptyset . This signal reveals privately him his true type as it is determined as follows

$$s(v, \theta) = \begin{cases} v & \text{if } \theta = g \\ \emptyset & \text{if } \theta = b \end{cases}$$

In order to make a difference between trading and not trading, there exists a cost of trading $\epsilon > 0$ paid by the fund manager.

The net return on investment obtained by the fund manager at time t is denoted by χ_t , and is defined by

$$\chi_t(a, p_t^a, p_t^b, v, \epsilon) = \begin{cases} v - p_t^a - \epsilon & \text{if } a = 1 \\ p_t^b - v - \epsilon & \text{if } a = 0 \\ 0 & \text{if } a = \emptyset \end{cases}$$

Untalented fund companies form a posterior belief about the fund manager's type based upon net returns yield by the portfolio, which is observed at the end of period 1. Similarly, the investor updates her belief about the fund company's type based on the same information. All of this is formalized by the posterior probabilities $\Pr(\theta = g|\chi_t)$ and $\Pr(\eta = t|\chi_t)$.

All contractual arrangements between the investor, fund companies and fund managers are exogenously set out. Furthermore, we model payoffs to fund companies and fund managers using a simple linear compensation structure. Accordingly, given the net

⁴This means that they are unable to condition thier action of their seniority (see Dasgupta and Prat 2006, [1], p. 11).

return χ_t , fees charged by the fund company to the investor correspond to $w_t = \delta\chi_t + \mu$. Similarly, the payment from the fund company to the manager is given by $\pi_t = \alpha\chi_t + \beta$. We assume that α and $\delta \in (0, 1)$, and β and $\mu \in (0, \infty)$.⁵

Hence, the total investor's payoff is given by⁶

$$\sum_{t=1}^2 (\chi_t - w_t)$$

and the total fund company's payoff is

$$\sum_{t=1}^2 (w_t - \pi_t).$$

To summarize, the timing is as follows:

$t = 1$

- The investor hires a fund company at random.
- The fund company learns τ_1 and chooses a hiring action e_1 .
- The fund manager learns s_1 and chooses a trading action a_1 .
- Traders observe a_1 and set prices.
- The investor and the fund company observe the net return yield by the portfolio.

All other traders observe v . Payments to the fund company and the fund manager are made.

$t = 2$

- The investor retains the incumbent fund company or hires a new one.
- The fund company retains the incumbent fund manager or, hires the challenger (chooses a hiring action e_2).⁷
- The fund manager observes s_2 and chooses a trading action a_2 .
- Traders observe a_2 and set prices.
- The investor and the fund company observe the net return yield by the portfolio.

All other traders observe v . Payments to the fund company and the fund manager are made.

3 The Results

3.1 The Churning Equilibrium

In this subsection we characterize a churning equilibrium in which both fund companies and fund managers always trade in the first period. This class of equilibrium is crucial

⁵Since both w_t and π_t depend on χ_t , the compensation scheme considers the possibility of a penalty whenever $\chi_t < 0$.

⁶We assume a zero discounting rate.

⁷We will see that in equilibrium this may occur only for untalented fund companies, as talented ones always hire good managers in the first period.

to get both non-fully informative prices and a high trading volume.

Proposition 3.1. *For α , δ , and ϵ low enough, there exists an equilibrium in which:*

- (i) *The investor retains the fund company if the portfolio's return is satisfactory (positive) and replaces him otherwise.*
- (ii) *A talented fund company always both hires good managers and retains them. An untalented fund company hires at random managers, and retains the incumbent manager if and only if the portfolio's return is satisfactory (positive).*
- (iii) *A good fund manager always trades. A bad fund manager churns if $t = 1$, and he does not trade if $t = 2$.*
- (iv) *Traders set prices*

$$\hat{p}_t^a = \frac{1}{2}(1 + \hat{\gamma}) \text{ and } \hat{p}_t^b = \frac{1}{2}(1 - \hat{\gamma})$$

where

$$\hat{\gamma} = \frac{2\zeta + (1 - \zeta)\gamma(2 + \frac{1}{2}(1 - \gamma))}{1 + \zeta + (1 - \zeta)\gamma(1 + \frac{1}{2}(1 - \gamma))}.$$

Proof. See the Appendix ■

Proposition 3.1 characterizes a churning equilibrium in which all managers trade in the first period. While the good manager trades according to his private information on the asset value, the bad one randomizes between buying and selling.

The investor knows that a successful trade in the first period ($\chi_1 > 0$) may stem from a talented fund company (which only hires good managers) or an untalented one. In the second case, this positive return may result from a good manager (with probability γ) or from a churning bad manager with good luck (with probability $(1 - \gamma)/2$). All of this suggests her that it is more likely that a successful trade comes from a talented fund company. Consequently, she makes an upward adjustment of her belief on a talented company when she observes $\chi_1 > 0$ so that the posterior becomes higher than the prior, i.e.,

$$\Pr(\eta = t | \chi_1 > 0) \geq \zeta.$$

Equivalently, the investor knows that an unsuccessful trade in the first period ($\chi_1 < 0$) can only be attributed to an untalented company. In addition, we assume that she believes that no-trade (an event out of the equilibrium path) can also only be associated to a untalented fund company. Based upon this structure of beliefs, the investor retains the first-period fund company if she observes a positive return, and replaces it otherwise.

Since a talented fund company knows perfectly the type of the manager, she only hires good ones. As a consequence, she always observes positive returns and retains the manager. In contrast, an untalented fund company cannot perfectly associate a

positive return to a good manager. However, she knows that it is more likely that a successful trade comes from a good manager than a bad one. Accordingly, she also makes an upward adjustment on her posterior when positive returns are observed so that

$$\Pr(\theta = g | \chi_1 > 0) \geq \gamma.$$

Given this structure of beliefs, an untalented fund company retains a manager only if a successful trade is observed at the first period.

A good manager always obtains positive returns whenever transaction costs are low enough ($\epsilon < \hat{\epsilon}$). Since he knows the true liquidation value of the asset, he always trades correctly and sells or buys according to prices that lie between 0 and 1. Given the structure of beliefs of the game, he knows that his continuation is ensured.

At first period, a bad manager has two alternatives: no-trade or churn. On the one hand, if he does not trade, he makes a zero return and thereby, he is revealed as a bad manager. As a result, he is replaced for sure. On the other hand, although a bad manager yields a negative expected return ($\hat{\epsilon} - 1/2 - \epsilon$) when churning, his chance of being retained is 50%. Given a linear compensation structure, a sufficient condition for the bad manager to prefer churning is the fact that the pay-for-performance sensitivity (the parameter α) be lower than the fixed payment (the parameter β). This occurs because in that case the benefits from being retained (the second-period fixed payment) overcome the costs of churning (a first-period *penalty* coming from a negative expected return).

Traders cannot distinguish if a market order comes from a good manager or a bad manager who churns at the first-period. The price is then based on the probability that the order is made by a good manager conditional on observing such an order. This probability corresponds to

$$\begin{aligned} \hat{\gamma} &= \Pr(\theta = g | a \in \{0, 1\}) \\ &= \frac{2\zeta + (1 - \zeta)\gamma(2 + \frac{1}{2}(1 - \gamma))}{1 + \zeta + (1 - \zeta)\gamma(1 + \frac{1}{2}(1 - \gamma))}. \end{aligned}$$

It can be verified that the posterior is larger than the prior, i.e., $\hat{\gamma} > \gamma$. The source of this fact is two-fold. First, as discussed above, while good managers are always retained, bad ones may be replaced. Second, even if a bad manager is not replaced, he does not trade in the second period.

Interestingly, the posterior in our model is *greater* than the posterior resulting from Dasgupta and Prat (2006, [1]) as

$$\hat{\gamma} > \gamma \frac{5 - \gamma}{2 + 3\gamma - \gamma^2} = \hat{\gamma}_{D\&P},$$

where $\hat{\gamma}_{D\&P}$ denotes the posterior in Dasgupta and Prat. This is due to the fact that our framework nests the environment studied by these authors as we also incorporate the possibility of *talented* fund companies that *only* hire *good* managers.

As a result, in our model, traders set equilibrium prices that yield a greater bid-ask spread than that characterized by Dasgupta and Prat. To see that, note that the bid-ask price is given by

$$\hat{p}_t^a - \hat{p}_t^b = \hat{\gamma}.$$

From this, it is clear that the bid-ask spread inherits all the properties of posterior probability, and thus, the result follows. Thus, our bid-ask price is larger than the Dasgupta and Prat's one for all $\gamma \in [0, 1)$ and $\zeta > 0$. Otherwise, they are equal. This property is illustrated in Figure 1, which shows that, as long as $\zeta > 0$ (i.e., there exists talented fund companies), our model delivers a higher bid-ask spread.⁸ This fact leads us to obtain results that are stronger than those of previous literature in terms of average trading (see Corollary 1 below).

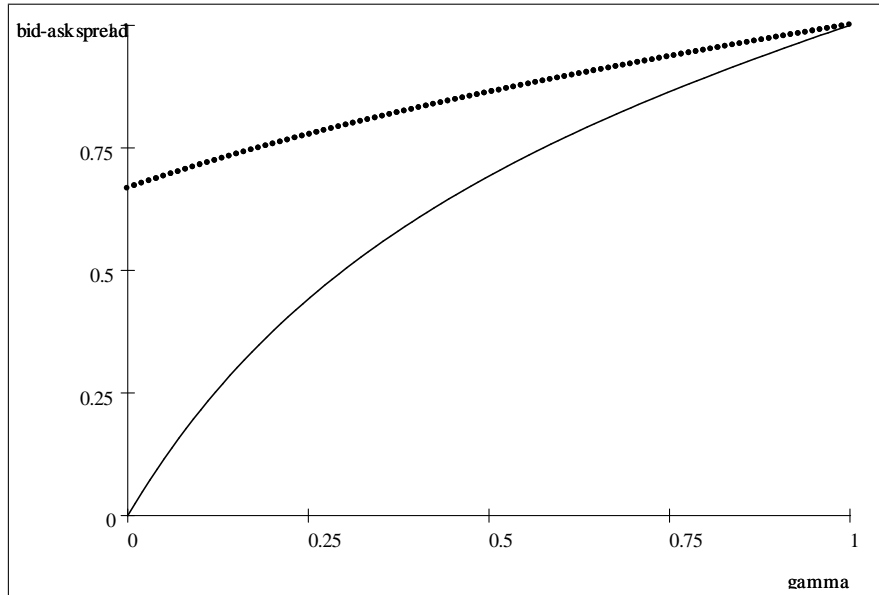


Figure 1. Bid-ask spread of Portilla (2008) with $\zeta = .5$ (dotted line), and Dasgupta and Prat (2006) (solid line).

In addition, note that since the posterior probability of facing a good manager is increasing with the proportion of talented fund companies, the bid-ask spread does so (see Figure 2).

⁸Figure 1 is constructed assuming that $\zeta = .5$.

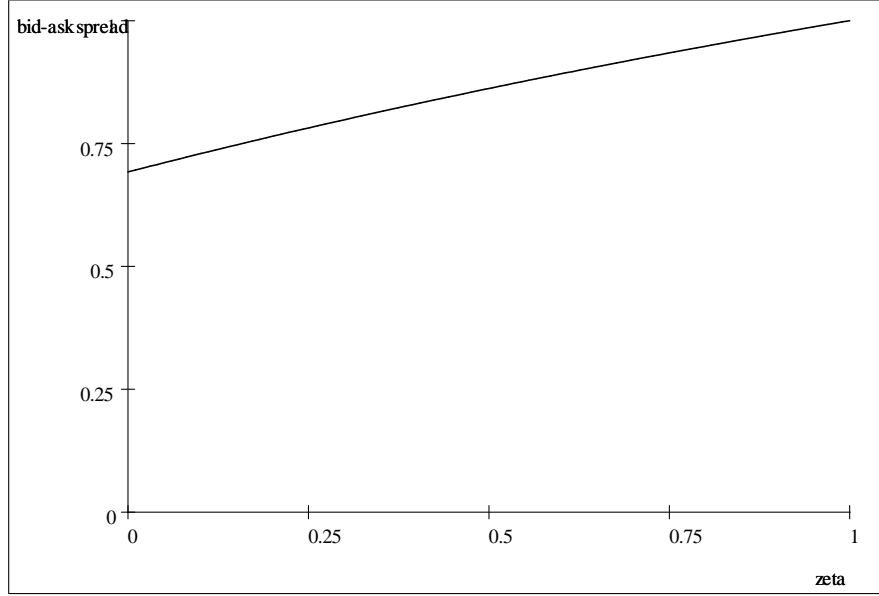


Figure 2. Bid-ask spread and proportion of talented fund companies assuming $\gamma = .5$.

3.2 Comparative Statics of Trading Volume

The main implication of Proposition 3.1 is the contribution to explaining the trade puzzle. Trading volume correspond to the expected number of assets traded as average in the two-period horizon. Thus, it is the average of the probability that a trade takes place at $t = 1$ and the probability that a trade takes place at $t = 2$. From Proposition 3.1, we compute in the next corollary the trading volume in the churning equilibrium.

Corollary 3.2. *The average trading volume in the churning equilibrium is*

$$w = \frac{2 + 3\gamma - \gamma^2}{4} + \frac{\zeta(1 - \gamma(1 + \frac{1-\gamma}{2}))}{2}.$$

Proof. See the Appendix ■

Some properties of the average trading volume are the following. First, it is positive even when the proportion of good managers tends to zero. This results from the presence of a churning equilibrium, which guarantees that the equilibrium in the financial market is not fully informative. Second, the average trading volume is increasing with the prior of both good managers (γ) and talented fund companies (ζ). This is consistent with the previous results related to the bid-ask spread. Third, our model delivers a trade volume that is *higher* than the Dasgupta and Prat's one for all $\gamma \in [0, 1)$ and $\zeta > 0$, and equal otherwise. This is true as it can be verified that

$$w = w_{D\&P} + \frac{\zeta(1 - \gamma(1 + \frac{1-\gamma}{2}))}{2}$$

where

$$w_{D\&P} = \frac{2 + 3\gamma - \gamma^2}{4}$$

is the average trading in Dasgupta and Prat (2006, [1]). This fact is also illustrated by Figure 3.

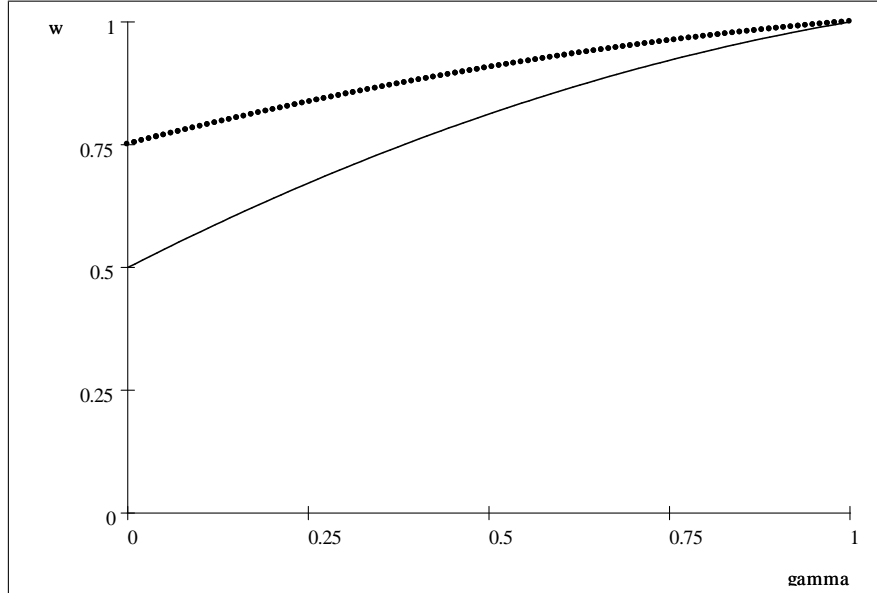


Figure 3. Average trading volume of Portilla (2008) with $\zeta = .5$ (dotted line), and Dasgupta and Prat (2006) (solid line).

Thus, our model allows to account not only for the positive, but also for the *large* trading activity observed in financial markets working under asymmetric information. The intuition of this result is as follows. The inclusion of an extra delegation stage in the financial contracting process provides us with an additional source of reputational concerns. As a consequence, the two-sided career concerns setup - in particular the presence of talented fund companies- ends up being crucial to strength previous reputational-based explanations of the trading puzzle.

4 Conclusions

This paper examines the equilibrium of a financial market in which there are two stages of portfolio management delegation: one from investors to fund companies, and the other one from fund companies to fund managers. In both agency relationships, agents are reputational concerned. That is, they face a positive probability of being fired if their first-period performance (measured in terms of the managed portfolio return) is not satisfactory for the principal. These implicit incentives lead to an uninformed manager to churn if his compensation scheme ensures him a fixed salary sufficiently high. Similarly, these career concern incentives lead to an uninformed fund company to

hire a manager even knowing that it is likely that he may be uninformed, and thus, he may generate a penalty against her. However, since the presence of churning managers increases the chance of getting a positive return, the chance of being retained by the investor for a fund company does so. As a result, if her compensation structure is so that the fixed component is sufficiently large, an uninformed fund company will decide to (randomly) hire a manager.

This double-sided career concern setup allows a churning equilibrium to emerge in which prices are not fully informative and the trading volume is positive and *high*. This is then the main contribution of our model: it strengthens previous explanations to the trade puzzle based on reputational concerns.

Finally, it is worthy to stress that our model provides results consistent with two stylized facts observed in financial markets during the last decades. First, an increasing participation of institutional investors has been accompanied by increasing trade volumes (Dow and Gorton 1997, [3]). Second, an increase of delegated portfolio management has lead to a higher trading activity (Cuoko and Kanel 2001, [4], Chevalier and Ellison 1997, [5], and 1999, [2]).

5 Appendix

Proof of Proposition 3.1. In order to obtain this equilibrium, we use the notion of Subgame Perfect Nash equilibrium (SPNE) and we then apply backward induction.

Manager's strategy (at $t = 2$). At $t = 2$, a bad manager never sells since $\hat{p}_2^b < 1/2$ guarantees that $\hat{p}_2^b - 1/2 - \epsilon < 0$. Likewise, it can be verified that a bad manager never buys as well because $\hat{p}_2^a > 1/2$ ensures that $1/2 - \hat{p}_2^a - \epsilon < 0$.

A good manager trades as long as transaction costs are low enough. He is strictly better off buying if $1 - \hat{p}_2^a - \epsilon > 0$, which is verified if $\epsilon < \frac{1}{2}(1 - \hat{\gamma}) \equiv \hat{\epsilon}$, and strictly better off selling if $\hat{p}_2^b - \epsilon > 0$, which is also satisfied if the same condition for transaction costs holds true.

Untalented fund company's belief. Possible first-period realizations of the net return are the following ones:

- (i) Successful purchase or sale: $\chi_1 = \hat{\epsilon} - \epsilon > 0$ provided that $\epsilon < \hat{\epsilon}$.
- (ii) Wrong purchase or sale: $\chi_1 = \hat{\epsilon} - 1 - \epsilon < 0$ because $\hat{\epsilon} < 1$.
- (iii) No trade: $\chi_1 = 0$.

Since only (i) and (ii) are observed in equilibrium, we can assume any conjecture for the result out of the equilibrium path. In particular, we assume a null probability. An untalented fund company then requires that their beliefs be consistent with equilibrium

play which implies that

$$\Pr(\theta = g|\chi_1) = \begin{cases} 0 & \text{if } \chi_1 < 0 \\ \frac{\zeta + \gamma(1-\zeta)}{\gamma\zeta + \frac{1}{2}(1+\gamma)(1-\zeta)} & \text{if } \chi_1 > 0 \\ 0 & \text{if } \chi_1 = 0 \end{cases}$$

which follows from

$$\begin{aligned} \Pr(\theta = g|\chi_1 > 0) &= \frac{\Pr(\theta = g, \chi_1 > 0)}{\Pr(\chi_1 > 0)} \\ &= \frac{\zeta + \gamma(1-\zeta)}{\gamma\zeta + \frac{1}{2}(1+\gamma)(1-\zeta)} \end{aligned}$$

since

$$\begin{aligned} \Pr(\theta = g, \chi_1 > 0) &= \Pr(\theta = g, \chi_1 > 0|\eta = t) \Pr(\eta = t) + \\ &\Pr(\theta = g, \chi_1 > 0|\eta = u) \Pr(\eta = u) \\ &= \zeta + \gamma(1-\zeta) \end{aligned}$$

and

$$\begin{aligned} \Pr(\chi_1 > 0) &= \Pr(\chi_1 > 0|\eta = t) \Pr(\eta = t) + \Pr(\chi_1 > 0|\eta = u) \Pr(\eta = u) \\ &= \gamma\zeta + \frac{1}{2}(1+\gamma)(1-\zeta) \end{aligned}$$

because

$$\begin{aligned} \Pr(\chi_1 > 0|\eta = t) &= \Pr(\chi_1 > 0|\eta = t, \theta = g) \Pr(\theta = g) \\ &+ \Pr(\chi_1 > 0|\eta = t, \theta = b) \Pr(\theta = b) \\ &= \gamma \end{aligned}$$

and

$$\begin{aligned} \Pr(\chi_1 > 0|\eta = u) &= \Pr(\chi_1 > 0|\eta = u, \theta = g) \Pr(\theta = g) \\ &+ \Pr(\chi_1 > 0|\eta = u, \theta = b) \Pr(\theta = b) \\ &= \gamma + \frac{1}{2}(1-\gamma). \end{aligned}$$

Moreover, it is possible to show that $\Pr(\theta = b, \chi_1 > 0) = 0$.⁹ The untalented fund company's best response is to retain if and only if the posterior is higher than the prior probability, i.e. if

$$\Pr(\theta = g|\chi_1) \geq \gamma.$$

⁹Since a good (bad) manager generates a positive (negative) expected portfolio return.

This is only satisfied by $\Pr(\theta = g|\chi_1 > 0)$ since

$$\begin{aligned} & \frac{\zeta + \gamma(1 - \zeta)}{\gamma\zeta + \frac{1}{2}(1 + \gamma)(1 - \zeta)} \stackrel{?}{\geq} \gamma \\ \iff & \zeta + \gamma(1 - \zeta) \stackrel{?}{\geq} \gamma \left[\gamma\zeta + \frac{1}{2}(1 + \gamma)(1 - \zeta) \right] \\ \iff & \zeta(1 - \gamma^2) \geq \gamma(1 - \zeta) \left[\frac{1}{2}(\gamma - 1) \right] \end{aligned}$$

which is true because the l.h.s. of the last expression is non-negative and the r.h.s. is non-positive.

Thus, the untalented fund company retains the incumbent fund manager if it observes a positive investment performance, and replaces him otherwise.

Talented fund company. Since the talented fund company only hires good managers, it always observes $\chi_1 > 0$ and thus, $\Pr(\theta = g|\chi_1) = 1$. As a result, this class of fund company always retains the good fund manager.

Investor's belief. The structure of the investor's beliefs is as follows. Possible realizations of the first-period net return imply that

$$\Pr(\eta = t|\chi_1) = \begin{cases} 0 & \text{if } \chi_1 < 0 \\ \frac{\zeta}{\gamma\zeta + \frac{1}{2}(1 + \gamma)(1 - \zeta)} & \text{if } \chi_1 > 0 \\ 0 & \text{if } \chi_1 = 0 \end{cases}$$

where

$$\begin{aligned} \Pr(\eta = t|\chi_1 > 0) &= \frac{\Pr(\eta = t, \chi_1 > 0)}{\Pr(\chi_1 > 0)} \\ &= \frac{\Pr(\eta = t)}{\Pr(\chi_1 > 0)} \\ &= \frac{\zeta}{\gamma\zeta + \frac{1}{2}(1 + \gamma)(1 - \zeta)}. \end{aligned}$$

Moreover, it is possible to show that $\Pr(\eta = u, \chi_1 > 0) = 0$ ¹⁰ The investor's best response is to retain if and only if the posterior is higher than the prior probability, i.e. if

$$\Pr(\eta = t|\chi_1) \geq \zeta.$$

This is only satisfied by $\Pr(\eta = t|\chi_1 > 0)$ since

$$\begin{aligned} & \frac{\zeta}{\gamma\zeta + \frac{1}{2}(1 + \gamma)(1 - \zeta)} \stackrel{?}{\geq} \zeta \\ \iff & \zeta(\gamma - 1) \leq (1 - \gamma), \end{aligned}$$

which is true as the l.h.s. of this expression is non-positive and the r.h.s. is non-negative. Thus, the investor retains the fund company if it observes a positive result, and replaces

¹⁰Since a good (bad) manager generates a positive (negative) expected portfolio return.

it otherwise.

Fund manager's strategy (at $t = 1$).

Good manager. If he plays $a_1 = s$, he generates a successful return at $t = 1$, i.e., $\chi_1 > 0$. Thus, the good manager is retained and his portfolio again yields a positive return at $t = 2$. The total good fund manager's total payoff corresponds to

$$\pi_g(a = s) = (\alpha\chi_1 + \beta) + (\alpha\chi_2 + \beta). \quad (5.1)$$

Notice that expected net returns generated by good managers are given by

$$E(\chi_t|success) = \hat{\epsilon} - \epsilon \quad (5.2)$$

Taking expectation(s) on (5.1) and using (5.2) yields

$$E\pi_g(a = s) = 2\alpha(\hat{\epsilon} - \epsilon) + 2\beta > 0,$$

which holds as $\epsilon < \hat{\epsilon}$.

Bad manager. At $t = 1$, he has two possibilities: trade (churn) or no trade. If he does not trade in the first period, he is not retained, and then, his payoff is

$$\pi_b(a = \phi) = \beta.$$

On the other hand, if he trades at $t = 1$, he successes and fails with the same probability. The expectation of the net return conditional on no successful trade is given by

$$E(\chi_t|failure) = \hat{\epsilon} - 1 - \epsilon < 0.$$

Thus, the bad fund manager's expected payoff corresponds to

$$\begin{aligned} E\pi_b(a = \{0, 1\}) &= \frac{1}{2}[E(t_1|success) + t_2] + \frac{1}{2}[E(t_1|failure)] \\ &= \frac{1}{2}[\alpha E(\chi_1|success) + 2\beta] + \frac{1}{2}[\alpha E(\chi_1|failure) + \beta] \\ &= \frac{1}{2}\alpha\{(\hat{\epsilon} - \epsilon) + (\hat{\epsilon} - 1 - \epsilon)\} + \frac{3}{2}\beta \\ &= -\alpha\left(\frac{\hat{\gamma}}{2} + \epsilon\right) + \frac{3}{2}\beta. \end{aligned}$$

Then, the bad manager churns if

$$E\pi_b(a = \{0, 1\}) > \pi_b(a = \phi) = \beta,$$

which is equivalent to the condition

$$\alpha \leq \frac{\beta/2}{\frac{\hat{\gamma}}{2} + \epsilon}.$$

Since $\epsilon < \hat{\epsilon}$, a sufficient condition is given by

$$\alpha \leq \beta.$$

Trader's Pricing Strategy. The probability that the second-period fund manager is good depends on whether the fund company is talented or untalented in the first period. In the first, case, this probability is one. In the second case, it depends on whether the fund company hires a good or bad manager in the first period. Notice that if an untalented fund company hires a bad manager, it can hire a good manager in the second period if the bad manager gets a unsuccessful net return at $t = 1$. All of this implies that the probability that the second-period fund manager is good corresponds to

$$\begin{aligned} \Pr(\theta = g, t = 2) &= \zeta + \left[\gamma + (1 - \gamma) \frac{1}{2} \gamma \right] (1 - \zeta) \\ &= \zeta + (1 - \zeta) \gamma \left[1 + \frac{1}{2} (1 - \gamma) \right] \end{aligned}$$

We have three kind of managers: second-period managers who trade only if they are good, first-period good managers who always trade and churners who randomize with the same probability between buying and selling. Thus, by symmetry,

$$\Pr(\theta = g | a = 1) = \Pr(\theta = g | a = 0) = \Pr(\theta = g | a \in \{0, 1\})$$

Then, a trader who receives a buy or sell order computes the following posterior probability:

$$\begin{aligned} \hat{\gamma} &= \Pr(\theta = g | a \in \{0, 1\}) \\ &= \frac{\Pr(\theta = g, a \in \{0, 1\})}{\Pr(a \in \{0, 1\})} \\ &= \frac{\Pr(\theta = g, a \in \{0, 1\}, t = 1) + \Pr(\theta = g, a \in \{0, 1\}, t = 2)}{\Pr(a \in \{0, 1\}, t = 1) + \Pr(a \in \{0, 1\}, t = 2)} \end{aligned}$$

Notice that $\Pr(\theta = g, a \in \{0, 1\}, t = 1)$ is given by

$$\begin{aligned} \Pr(\theta = g, a \in \{0, 1\}, t = 1 | \eta = t) \Pr(\eta = t) &+ \Pr(\theta = g, a \in \{0, 1\}, t = 1 | \eta = u) \Pr(\eta = u) \\ &= \zeta + \gamma(1 - \zeta) \end{aligned}$$

and $\Pr(\theta = g, a \in \{0, 1\}, t = 2)$ corresponds to

$$\begin{aligned} \Pr(\theta = g, a \in \{0, 1\}, t = 2 | \eta = t) \Pr(\eta = t) &+ \Pr(\theta = g, a \in \{0, 1\}, t = 2 | \eta = u) \Pr(\eta = u) \\ &= \zeta + (\gamma + (1 - \gamma) \frac{1}{2} \gamma)(1 - \zeta). \end{aligned}$$

Moreover,

$$\Pr(a \in \{0, 1\}, t = 1) = 1,$$

and

$$\begin{aligned}\Pr(a \in \{0, 1\}, t = 2) &= \Pr(\theta = g, t = 2) \\ &= \zeta + (\gamma + (1 - \gamma)\frac{1}{2}\gamma)(1 - \zeta)\end{aligned}$$

Thus,

$$\hat{\gamma} = \frac{2\zeta + (1 - \zeta)\gamma(2 + \frac{1}{2}(1 - \gamma))}{1 + \zeta + (1 - \zeta)\gamma(1 + \frac{1}{2}(1 - \gamma))}.$$

With this probability, the trader computes the next ask price:

$$\begin{aligned}\hat{p}_t^a &= \Pr(\theta = g|a \in \{0, 1\})E(v|\theta = g, a = 1) + \Pr(\theta = b|a \in \{0, 1\})E(v|\theta = b, a = 1) \\ &= \hat{\gamma} + (1 - \hat{\gamma})\frac{1}{2} \\ &= \frac{1}{2}(1 + \hat{\gamma}),\end{aligned}$$

and the bid price:

$$\begin{aligned}\hat{p}_t^b &= \Pr(\theta = g|a \in \{0, 1\})E(v|\theta = g, a = 0) + \Pr(\theta = b|a \in \{0, 1\})E(v|\theta = b, a = 0) \\ &= \hat{\gamma}0 + (1 - \hat{\gamma})\frac{1}{2} \\ &= \frac{1}{2}(1 - \hat{\gamma}).\end{aligned}$$

■

Proof of Corollary 3.2. The average trading volume is given by

$$w = \frac{\Pr(a \in \{0, 1\}, t = 1) + \Pr(\theta = g, a \in \{0, 1\}, t = 2)}{2}$$

where

$$\Pr(a \in \{0, 1\}, t = 1) = 1,$$

and

$$\begin{aligned}\Pr(\theta = g, a \in \{0, 1\}, t = 2) &= \Pr(a \in \{0, 1\}, t = 2) \\ &= \Pr(a \in \{0, 1\}, \theta = g, t = 2|\eta = t)\Pr(\eta = t) \\ + \Pr(a \in \{0, 1\}, \theta = g, t = 2|\eta = u)\Pr(\eta &= u) \\ &= \zeta + (1 - \zeta)(\gamma + (1 - \gamma)\frac{\gamma}{2}).\end{aligned}$$

Hence,

$$w = \frac{2 + 3\gamma - \gamma^2}{4} + \frac{\zeta(1 - \gamma(1 + \frac{1-\gamma}{2}))}{2}.$$

■

References

- [1] Dasgupta, A. and A. Prat (2006). Financial Equilibrium with Career Concerns, *Journal of Theoretical Economics* 88, pp. 288-307.
- [2] Chevalier, J. and G. Ellison (1999). Career Concerns of Mutual Fund Managers, *Quarterly Journal of Economics* 114(2), pp. 389-432.
- [3] Dow, J. and G. Gorton (1997). Noise Trading, Delegated Portfolio Management, and Economic Welfare, *Journal of Political Economy* 105(5), pp. 1024-1050.
- [4] Cuoco, D. and R. Kaniel (2001). Equilibrium Prices in the Presence of Delegated Portfolio Management, Working Paper, University of Pennsylvania, 2001.
- [5] Chevalier, J. and G. Ellison (1997). Risk Taking by Mutual Funds as a Response to Incentives, *Journal of Political Economy* 105(6), pp. 1167-1200.

Audit Contracts and Reputation^{*}

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Abstract

This paper characterizes the contractual relationship between an external auditor and a manager of a client firm when the incentives for both agents are implicit as in the career concerns framework. The main result is that the earning management and the audit effort are decreasing over time because the incentives to build a reputation also decline for both agents in spite of a manager's first mover advantage. This suggests that the audit effort should be higher when the auditor is an emerging firm and the future employment opportunities for the client firm's manager are larger.

Key words. Contract theory; career concerns; reputation; auditing.

Journal of Economic Literature. Classification Number: C73, G38, D82, D83.

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1 Introduction

External auditors are frequently paid according to a scale of fees set for each class of worker-hours used during the audit, which in turn depends on the ability and/or the historical productivity of the human resources engaged in the process. Although the total number of worker-hours can be different for each client firm according to its size, the unitary fees are the same for all clients and the fulfillment of this plan of hours is indeed not certified *ex post* by other agents. Furthermore, the task of the auditor is considered fully attained with the preparation of a report about the truthfulness or the veracity of the financial statements. However, the audit process that constitutes the background for the opinion contained in this report is seldom evaluated or audited by a third party.¹ All of this means that in practice the audit firm is rewarded *in advance* and that its compensation scheme is *no* contingent neither on the quantity nor on the quality of the audit effort actually exerted.

Both the no contingent nature of this reward scheme and the lack of monitoring on the audit activity rise interesting questions about the actual incentives that external auditors have to do their job properly. The central hypothesis of this paper is that the answer to this issue seems to come from the prospective opportunities offered to the auditors by the market. These opportunities can materialize through the incorporation of new clients or the renovation of the contracts open with the current ones. Accordingly, they can be interpreted as *implicit* and *dynamic* incentives similar to those known in contract theory as *career concerns*.

On the other side of the auditing contract, we have the client firm, and more specifically, its manager. In the context of the audit relationship, the main action undertaken by the manager concerns the announcement of the company's financial statements, which constitutes the major input for the auditor's task. Nevertheless, the plenty of scandals related to the manipulation of these statements observed especially during the last decade, supports strongly the choice of modelling the manager's report as a non-truth-telling and strategic behavior referred to as *earning management*. As an important part of the manager's incentives seems to come from his future employment opportunities, it is reasonable to conjecture that the stimulus of earning management also stems from his implicit incentives.² As a consequence, we argue that career concerns also offer a suitable approach to explain the main driving force of this managerial

¹In 2002, U.S. Congress past the Sarbanes-Oxley Act (SOX, hereafter), the most important securities exchange legislation over the last two decades in order to guarantee the transparency in financial markets. Nevertheless, there is no law that demands the existence of an independent firm that certifies external auditor's reports.

²In this case, the implicit incentives for the manager are given by perspectives of promotions or better outside opportunities.

behavior.

This paper characterizes the contractual relationship between an audit firm and a client firm's manager when the incentives for both agents are implicit. To this end, starting from a career concerns model in the spirit of Holmström (1999), we innovate by allowing in each period a sequential game between both parties with a strategic interaction through their respective disutility functions. In such a game, on the one side, the leader position is held by the manager, who has to decide about the disclosure of information on his company's financial situation through the accounting statements. On the other side, the auditor observes this signal and has to make a choice about how much effort he is willing to undertake in order to verify if such a signal represents reasonably the audited firm's financial position.

Our main finding is that earning management and audit effort are *decreasing* over time because the incentives to build a reputation also decline for both agents. However, as our innovation introduces a new source of (current) incentives for both agent's actions, the increasing lazy behavior of the auditor may be offset if his counterpart is in an earlier stage of its career. As a result, the model predicts a continuum of cases depending on which stage of their careers contractual parties are, with two polar cases. On the one side, we have the *best* scenario from a social point of view, that is, the case in which the probability of having *non-detected earning management* is minimized. Accordingly, our results suggest that auditing efforts should be high when the auditor is an emerging firm and/or the future employment opportunities for the manager are large. On the other side, our model also predicts the *worst* scenario from a social viewpoint, that is, the situation in which the probability of having *non-detected earning management* is maximized. In fact, under our double-career-concerns approach, non-detected earning management actions are expected to be higher as long as the manager is at a very early stage of his career, and the auditor is an old firm in the market.

Thus, our model provides an *alternative* explanation to recent scandals involving collusion between auditors and managers to manipulate financial statements in U.S.³ In fact, most of the previous literature has accounted for these scandals based on the possible conflict of interests that audit firms face when providing jointly auditing and consulting services (see, among others, Antle, 1984; Simunic, 1984; Firth, 1997; and Ruiz Barbadillo et al., 2006). In contrast, our approach highlights the relevance of career concerns held by *both* parties of audit contracts, but focusing only on the auditing

³ These scandals include, among others, Enron, WorldCom, Tyco, Imclone and Adelphia. It is important to note that our model delivers two conditions to be tested when manipulations were performed: (i) if these companies were run by manager teams with large career concerns, and (ii) if these audit firms were old participants in the market.

services. Although a multi-task approach can contribute to improve the understanding of these scandals, this should constitute the aim of future research.

Our analysis also contributes to clarify the incentives behind the relationship among shareholders, auditors and managers. Under certain circumstances, our theoretical framework show inefficiencies in the auditing process given the two-sided career concern framework. This result supports the existence of either an independent firm or an independent audit committee inside the board that certifies the audit process. This would improve the quality of the information revealed to financial markets and mitigate these inefficiencies.

This paper is related to the abundant literature on career concern for executives (Fama, 1980; Holmström, 1999; and Meyer and Vickers, 1997). However, to the best of our knowledge, so far this approach has not be used to model the relationship between an external auditor and a client firm. Furthermore, a two-sided career concern framework remains almost unexplored within the contract theory literature. One recent exception is Song and Thakor (2006), who study the relationship between the Chief Executive Officer (CEO) and the Board of Directors when both of them have implicit incentives in a career concerns fashion. They contemplate a project selection setting in which the CEO has the responsibility for generating project ideas and providing the board with the information necessary to evaluate them. Their main result is that whereas the board's career concerns cause it to distort its investment recommendation pro-cyclically, the CEO's career concerns cause her to sometimes reduce the precision of the board's information. Nevertheless, and in contrast to our paper, this work does not model the relationship between both parties by means of a strategic and dynamic interaction. Thus, our paper contributes to the contract theory literature by exploiting a richer environment that incorporates two innovations: a bilateral career concern setting, and a first-mover advantage for one the career-concerned agents (the manager).

This paper proceeds as follows. Section 2 constructs a career concerns model of audit contract in the spirit of Holmström (1999), but with a sequential game played by the auditor and the manager in each period. Section 3 characterizes the equilibrium of the game and discusses the principal results. Finally, Section 4 concludes and points up some limitations and extensions. All the proofs are contained in the Appendix.

2 The Model

In this section we characterize the relationship between three agents with infinite horizon: an audit firm, the manager of a client firm, and the market.

2.1 The manager

The client firm's manager decides about the announcement of a signal that we summarize as x_t , the account earnings in period t , and whose "technology" is defined as follows

$$x_t = \theta + a_t + \epsilon_t \quad \forall t = 1, 2, \dots \quad (2.1)$$

where θ represents some managerial characteristic like talent or ability which is unknown not only for the market but also for the manager. However, all agents share the same prior distribution of this managerial ability described by

$$\theta \sim N(m_1, \frac{1}{h_1}),$$

where $m_1 \equiv E(\theta)$ and $h_1 \equiv 1/V(\theta)$ corresponds to the level of precision of θ . Moreover, $a_t \in \mathbb{R}$ represents the level of *earning management* chosen by the manager at period t . Finally, ϵ_t is a stochastic noise term which is independent and identically distributed as follows

$$\epsilon_t \sim N(0, \frac{1}{h_\epsilon}),$$

where h_ϵ corresponds to the level of precision of ϵ .

We assume that the manager is risk neutral and exhibits the following separable utility function

$$U_M(c, a) = \sum_{t=1}^{\infty} \delta^{t-1} [c_t - g(a_t, e_t)], \quad (2.2)$$

where $c_t > 0$ is the consumption at period t and $g(\cdot)$ is an increasing and convex function in a_t that represents the disutility of earning management actions to the manager. In addition, $g(\cdot)$ depends on e_t , the current auditing effort decision made by the auditor, what we will detail later. For now, we suppose that $g(\cdot)$ is an increasing and convex function in e_t . This reflects the idea that the earning management actions are more costly when the level of anticipated auditing efforts are large because in this case it is more difficult to fool the auditor. Furthermore, we assume that the marginal disutility of the managerial actions is increasing in the auditing effort. All these assumptions can be summarized as follows

$$\begin{aligned} g_a(\cdot) &\equiv \frac{\partial g(\cdot)}{\partial a_t} > 0; \quad g_{aa}(\cdot) \equiv \frac{\partial g_a(\cdot)}{\partial a_t} > 0; \\ g_e(\cdot) &\equiv \frac{\partial g(\cdot)}{\partial e_t} > 0; \quad g_{ee}(\cdot) \equiv \frac{\partial g_e(\cdot)}{\partial e_t} > 0; \\ g_{ae}(\cdot) &\equiv \frac{\partial g_a(\cdot)}{\partial e_t} > 0. \end{aligned}$$

The earning management decision has two objectives. The first one has a current effect and the second one has a long run effect. First, we assume that in each period

the manager and the auditor play a sequential game in which the manager exhibits a first mover's advantage. Thus, in each period t , the manager chooses a level of a_t , and according to (??) also a signal x_t , with the aim of influencing the effort level exerted by the auditor in this period. Since the auditor only observes x_t , we need to assume that the level of earnings announced by the manager is a "good" signal for the level of earning management actions in the sense of that the joint density $f(x; a)$ satisfies the *monotone likelihood ratio property* (MLRP).⁴

Second, the manager decides a level of earning management as a try to influence, through the signal x_t , the learning process of the market about the managerial ability θ . As in the career concerns literature, the link between the past managerial decision and the unknown managerial characteristic is given by the prospective incomes of top executives. These may be associated to future employment opportunities for the manager given by promotions or better outside opportunities. In consequence, we assume that the incomes associated to future employment opportunities for the manager depend on the past realizations of the signal x_t . This signal in turn depends stochastically on the manager's past decisions about a_t as pointed out by equation (??). We summarize these future incomes in the wage function $w_t(x^{t-1})$ that represents the wage paid in period t based on the vector $x^{t-1} = (x_1, \dots, x_{t-1})$. This vector represents a sequence of realizations of the signal x up to time $t - 1$, what we call *history* of x .

Since there are a double causality between today earning management actions and future wages, both the decision rule $a_t(\cdot)$ and the wage functions $w_t(\cdot)$ are determined simultaneously in equilibrium.

2.2 The Auditor

Since we assume that the audit firm is managed by its owner, we do not distinguish between the audit firm's manager and the audit firm itself, and thus hereafter we only talk generically about *the auditor*. The auditor must elaborate a report with his opinion about the truthfulness of the signal x_t disclosed by the manager. We model this situation as a new signal r_t , the *adjusted earnings report* at period t , that is, a number that depends stochastically on the audit efforts in the following fashion:

$$r_t = \phi + e_t + \xi_t \quad \forall t = 1, 2, \dots \quad (2.3)$$

where ϕ represents some auditor's characteristic like ability or productivity which is unknown not only for the market and the client firm but also for the auditor. However,

⁴That is, we assume that $f_a(x; a) > 0$ and that

$$\frac{\partial}{\partial x} \left(\frac{f_a(x; a)}{f(x; a)} \right) > 0.$$

all agents share the following prior distribution of the auditor's ability

$$\phi \sim N(n_1, \frac{1}{k_1}),$$

where $n_1 \equiv E(\phi)$ and $k_1 \equiv 1/V(\phi)$ corresponds to the level of precision of ϕ . In addition, $e_t \geq 0$ represents the level of auditing effort chosen by the auditor at period t . Finally, ξ_t is a stochastic noise term which is independent and identically distributed as follows

$$\xi_t \sim N(0, \frac{1}{k_\xi}),$$

where k_ξ corresponds to the level of precision of ξ .

The auditor is risk neutral and has the following separable utility function

$$U_A(\tau, e) = \sum_{t=1}^{\infty} \delta^{t-1} [\tau_t - \psi(e_t, x_t)] \quad (2.4)$$

where $\tau_t \in \mathbb{R}$ represents the auditor's income at period t and $\psi(\cdot)$ is an increasing and convex function in e_t that measures the disutility of the auditing effort. The function $\psi(\cdot)$ also depends on x_t , the current signal announced by the manager. We assume that $\psi(\cdot)$ is an increasing and convex function in x_t . This assumption is based on the idea that the auditing effort is more costly as long as the level of earning management actions, underlying in higher level of x_t , is larger. This is because it is more difficult for the auditor to detect a cheating behavior.⁵ Moreover, we suppose that the marginal disutility of the auditing effort is decreasing in the signal announced by the manager. In sum, we are assuming the following situation

$$\begin{aligned} \psi_e(\cdot) &\equiv \frac{\partial \psi(\cdot)}{\partial e_t} > 0; \quad \psi_{ee}(\cdot) \equiv \frac{\partial^2 \psi(\cdot)}{\partial e_t^2} > 0; \\ \psi_x(\cdot) &\equiv \frac{\partial \psi(\cdot)}{\partial x_t} > 0; \quad \psi_{xx}(\cdot) \equiv \frac{\partial^2 \psi(\cdot)}{\partial x_t^2} > 0; \\ \psi_{ex}(\cdot) &\equiv \frac{\partial^2 \psi(\cdot)}{\partial e_t \partial x_t} < 0. \end{aligned}$$

As in the case of the manager, the auditing effort decision has two objectives. Again, there is one objective that has a current effect and another which has a long run effect. First, in each period t , the auditor chooses a decision rule (s reaction function) of e_t , and according to (2.3) also a signal r_t . Since the manager has a first mover's advantage, he can anticipate this decision rule, which implies finally that the auditor can influence the level of earning management actions undertaken by the manager in this period through the disutility function $g(a_t, e_t)$.

In addition, the auditor also decides a level of auditing effort as an attempt to influence, through the signal r_t , the market's future perception about ϕ . In this case,

⁵ Again, the assumption of MLRP is crucial for this fact to be held.

the underlying driving force that permits the relationship between the past decision about e_t and the unknown auditor's characteristic ϕ are his implicit incentives. These career concern-based incentives are given by the auditor's incomes associated to the prospective opportunities arisen from contracts with new clients, and/or the renovation of relationships maintained with some current clients. Thus, we assume that these incomes depend on the past realizations of the signal r_t , which in turn depend stochastically on the auditor's past decisions about e_t as (2.3) establishes.⁶ We summarize these future opportunities in the income function $\tau_t(r^{t-1})$ that represents the incomes obtained in period t based on the vector $r^{t-1} = (r_1, \dots, r_{t-1})$. This vector describes the history of the signal r up to time $t - 1$.

Given the interaction between today auditing efforts and future incomes, both the decision rule $e_t(\cdot)$ and the income functions $\tau_t(\cdot)$ are determined simultaneously in equilibrium.

2.3 The Market

We suppose that the future opportunities for both the manager and the auditor depend on the assessment of their abilities made by the market. This is an abstract agent who gathers all available information concerning not only the signals disclosed by the other two agents in *previous* periods, but also is able to anticipate *perfectly* the decision rule chosen by them in *all* periods. These two sources of information are though not enough to reveal fully the realization of the random variables θ and ϕ . Thus, the market can only to improve its perception of these unknown characteristics over time through the following learning processes.

For the managerial ability, given the assumptions made on normality and independence, the market's learning process is characterized by the following posterior distribution⁷

$$\theta \mid x^t \sim N(m_{t+1}, \frac{1}{h_{t+1}})$$

with

$$m_{t+1} \equiv E(\theta \mid x^t) = \frac{h_t m_t + h_\epsilon z_t}{h_t + h_\epsilon} = \frac{h_1 m_1 + h_\epsilon \sum_{s=1}^t z_s}{h_1 + t h_\epsilon}, \quad (2.5)$$

$$h_{t+1} \equiv 1/V(\theta \mid x^t) = h_t + h_\epsilon = h_1 + t h_\epsilon, \text{ and} \quad (2.6)$$

$$z_t \equiv x_t - a_t^*(x^{t-1}) \quad (2.7)$$

⁶Now we assume implicitly that $f_e(r; e) > 0$ and that the level of reported adjusted earnings r_t is a "good" signal for the level of auditing effort in the sense of that the joint density $f(r; e)$ satisfies the MLRP defined as follows

$$\frac{\partial}{\partial r} \left(\frac{f_e(r; e)}{f(r; e)} \right) > 0.$$

⁷See DeGroot (1970).

Notice that the mean process $\{m_t\}$ is a random walk with incremental variance which declines to zero as $t \rightarrow \infty$, which means that in the limit θ will become fully known.

The intuition of this learning process is that at period t the market observes the earnings x_t announced by the manager, but the former filters this public signal through the perfect inference of the optimal decision rule a_t^* . In other words, the manager tries to manipulate the earnings in order to influence the market's posterior perception about his managerial ability, and in this way, to affect his future wages. However, we assume that in equilibrium the market is able to anticipate perfectly this cheating behavior and improve the signal received. This improved signal is denoted by z_t , which however does not reveal fully the realization of the managerial ability because it still keeps a source of noise arisen from the term ϵ_t .⁸

On the auditor side, the market's learning process on the auditing ability is characterized by the following posterior distribution⁹

$$\phi \mid r^t \sim N(n_{t+1}, \frac{1}{k_{t+1}})$$

with

$$n_{t+1} \equiv E(\phi \mid r^t) = \frac{k_t n_t + k_\xi l_t}{k_t + k_\xi} = \frac{k_1 n_1 + k_\xi \sum_{s=1}^t l_s}{k_1 + t k_\xi}, \quad (2.8)$$

$$k_{t+1} \equiv 1/V(\phi \mid r^t) = k_t + k_\xi = k_1 + t k_\xi, \text{ and} \quad (2.9)$$

$$l_t \equiv r_t - e_t^*(r^{t-1}, x_t^*) \quad (2.10)$$

As in the case of the managerial ability, the mean process of the audit ability $\{n_t\}$ is also a random walk with incremental precision that diverges as $t \rightarrow \infty$. Hence, in the limit ϕ also becomes completely known.

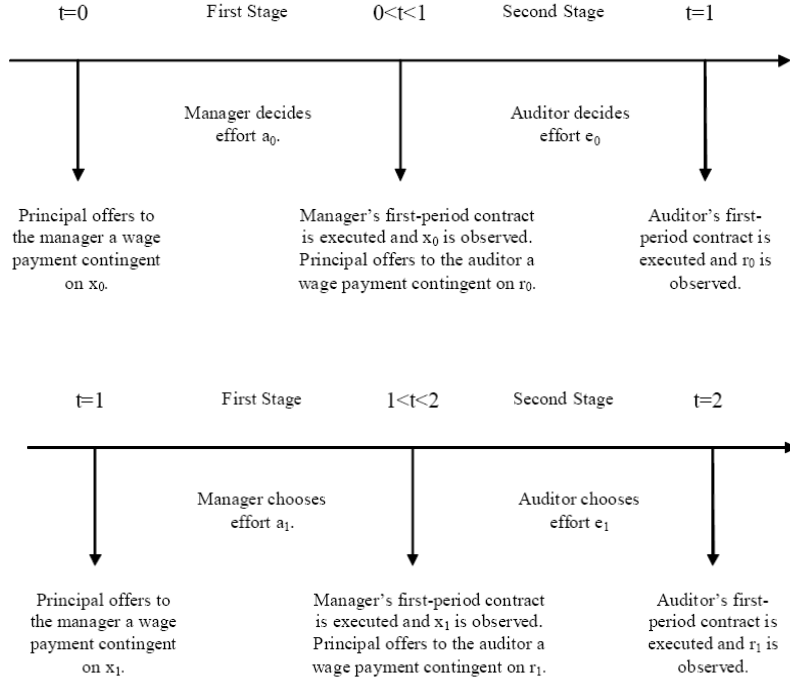
The intuition behind of this learning process is the following one. At period t , the market observes the adjusted earning report r_t disclosed by the auditor, but the former improves this public signal anticipating perfectly the optimal decision rule chosen by the latter concerning to the level of auditing effort. Despite the auditor's attempts to influence the market's assessment of his ability and his future incomes, we assume that in equilibrium the market cannot be confused by the auditor's decision. Consequently, the market constructs an improved signal denoted by l_t , which still contains a noisy element ξ_t that prevents to know perfectly the realization of the auditing characteristic ϕ .¹⁰

An illustration of the timing of the game is given by the following figure when $T = 2$.

⁸In fact, from (2.1) and (2.7) we know that $z_t = \theta + \epsilon_t$, and hence, $z_t \mid x^{t-1} \sim N(m_t, \frac{1}{h_t} + \frac{1}{h_\epsilon})$.

⁹See DeGroot (1970).

¹⁰In fact, from (2.3) and (2.10) we known that $l_t = \phi + \xi_t$, and thus, $l_t \mid r^{t-1} \sim N(n_t, \frac{1}{k_t} + \frac{1}{k_\xi})$.



3 Characterization of the Equilibrium

According to the timing of the problem, the manager's optimal decision $a_t^*(x^{t-1}, r^{t-1})$ and the auditor's optimal decision $e_t^*(r^{t-1}, x_t^*)$ are the result of a sequential game played by both agents at period t . In this game, the manager exhibits a first mover's advantage. In consequence, we need to apply backward induction in each period, which means to characterize the solution of this game as a problem with two stages.

Likewise, since we assume that the agents are risk neutral and forward looking for infinite periods, and that there is neither borrowing nor saving, this problem can be written as a dynamic program at $t = 1$. In this formulation, the agents choose a sequence of actions that maximizes their expected utilities and characterizes the path of sub-perfect Nash equilibria (SPNE) of this game.¹¹ Furthermore, we assume that shareholders assess both manager's ability and auditor's productivity inside each of both competitive labor markets. This means that shareholders are the principals in the two agency relationships. In addition, we restrict our model to the case when all the bargaining power is on the agent's hands in both markets.

¹¹The assumption that there is neither saving nor borrowing for the manager means that $c_t = w_t$ for all t . Notice that this assumption implies that we do not need to assume that the capital market is perfect.

Since the relevant variables are functions of the history of the signals r and x - unknown at time $t = 1$ -, we apply the unconditional expectation to the objective functions. Finally, all this leads us to the problem described by the following two steps.

I. The Auditor's Problem. For a given sequence of random variables $\{x_t\}_{t=1}^{\infty}$, which has implicit a sequence of manager's actions $\{a_t\}_{t=1}^{\infty}$, the auditor chooses the non-stochastic sequence of reaction functions $\{e_t(r^{t-1}, x_t)\}_{t=1}^{\infty}$ that solves the following program:

$$\max_{\{e_t(\cdot)\}_{t=1}^{\infty}} EU_A(\tau, e) = \sum_{t=1}^{\infty} \delta^{t-1} [E\tau_t(r^{t-1}) - E\psi(e_t(r^{t-1}), x_t)] \quad (3.1)$$

$s.t.$

$$\tau_t(r^{t-1}) = E(r_t | r^{t-1}) = E(\phi | r^{t-1}) + e_t(r^{t-1}) \quad \forall t = 1, 2, \dots \quad (3.2)$$

where constraint (3.2) represents the auditor's incomes that a competitive and risk neutral principal sets in each period t . Notice that we assume that the prospective incomes for the auditor depend on the level of past reported adjusted earnings r^{t-1} . This modelling choice is based on the idea that the external auditor are hired directly by the shareholders or other body autonomous of the manager such as the board of directors or the controller of the company. This justifies that we can model the future opportunities the market offers to the auditor as dependent on his adjusted earnings report.

II. The Manager's Problem. Taking into account the sequence of non-stochastic reaction functions $\{e_t(r^{t-1}, x_t)\}_{t=1}^{\infty}$, the manager chooses the sequence of non-stochastic earning management actions $\{a_t^*(x^{t-1}, r^{t-1})\}_{t=1}^{\infty}$, which in turn determines the sequence of random signals $\{x_t^*\}_{t=1}^{\infty}$ so that

$$\max_{\{a_t(\cdot)\}_{t=1}^{\infty}} EU_M(w, a) = \sum_{t=1}^{\infty} \delta^{t-1} [Ew_t(x^{t-1}) - Eg(a_t(x^{t-1}), e_t(r^{t-1}, x_t))] \quad (3.3)$$

$s.t.$

$$w_t(x^{t-1}) = E(x_t | x^{t-1}) = E(\theta | x^{t-1}) + a_t(x^{t-1}) \quad \forall t = 1, 2, \dots \quad (3.4)$$

where now constraint (3.4) represents the managerial wages that a competitive and risk neutral principal sets in each period t . Thus, the prospective incomes for the auditor depend on the level of earnings announced by the manager in the past. In this contract, the principals are the shareholders or the board of directors, who are assumed to be autonomous of the manager.

The next statement characterizes the equilibrium of this game.

Proposition 3.1. *The equilibrium of the game described by the auditor's and the manager's problem is characterized by the vector of sequences $\{(a_t^*, e_t^*(x_t^*), w_t^*, \tau_t^*)\}_{t=1}^{\infty}$.*

In this equilibrium, $\{[a_t^*(x^{t-1}, r^{t-1}), e_t^*(r^{t-1}, x_t^*)]\}_{t=1}^\infty$ represents the sequence of non-stochastic SPNE profiles of the game played between the manager and the auditor at each period. Moreover, $\{x_t^*\}_{t=1}^\infty$ denotes the sequence of random signals announced by the manager when he decides to exert the sequence of optimal earning management actions $\{a_t^*\}_{t=1}^\infty$. Finally, w_t^* and τ_t^* represent the wage sequences of the manager and the auditor, respectively.

Notice that the principal anticipates perfectly the SPNE profile $(a_t^*, e_t^*(x_t^*))$ and uses these correct conjectures to filter the signals disclosed by both the manager and the auditor. This implies that the market uses signals z^{t-1} and l^{t-1} instead x^{t-1} and r^{t-1} , respectively. All this together with the learning processes described by (2.6) and (2.9) allow to write the constraints of the problem as follows

$$\tau_t(r^{t-1}) = n_t(l^{t-1}) + e_t^*(r^{t-1}, x_t^*) \quad \forall t = 1, 2, \dots \quad (3.5)$$

and

$$w_t(x^{t-1}) = m_t(z^{t-1}) + a_t^*(x^{t-1}, r^{t-1}) \quad \forall t = 1, 2, \dots \quad (3.6)$$

where $z^{t-1} = (z_1, \dots, z_{t-1})$ and $l^{t-1} = (l_1, \dots, l_{t-1})$. Taking expectations on (3.5), with auditing effort fixed and non-contingent, yields

$$\begin{aligned} E\tau_t(r^{t-1}) &= En_t(l^{t-1}) + Ee_t^*(r^{t-1}, x_t^*) \quad \forall t = 1, 2, \dots \\ &= \frac{k_1 n_1}{k_t} + \frac{k_\xi}{k_t} \sum_{s=1}^{t-1} [n_1 + e_s - Ee_s^*(r^{s-1}, x_s^*)] + Ee_t^*(r^{t-1}, x_t^*) \end{aligned} \quad (3.7)$$

Hence, for a non-stochastic equilibrium path of auditing efforts $\{e_t^*(r^{t-1}, x_t^*)\}_{t=1}^\infty$, the *marginal return* to e_s in period t for all $s < t$ does *not* depend on the past because

$$\frac{\partial E\tau_t(r^{t-1})}{\partial e_s} = \frac{k_\xi}{k_t} \equiv \beta_t \quad (3.8)$$

A similar line of reasoning for the manager's problem leads to the marginal return to a_s in period t for all $s < t$ does not depend on the past neither since

$$\frac{\partial Ew_t(x^{t-1})}{\partial a_s} = \frac{h_\epsilon}{h_t} \equiv \alpha_t. \quad (3.9)$$

Thus, the next lemma states a useful property concerning marginal returns to both agents' actions for characterizing the equilibrium.

Lemma 3.2. *The present value of the marginal return to both auditing effort and earning management is decreasing over time.*

On the side of costs, note that the *marginal expected cost* to e_s is equal to $\Psi(e_s)$, the expected marginal cost to e_s so that

$$\frac{\partial E\psi(e_s, x_s)}{\partial e_s} = E\psi'_e(e_s, x_s) \equiv \Psi(e_s, x_s).$$

Moreover, the marginal expected cost to managerial actions a_s is given by

$$g'_a(a_t^*, e_t^*(x_t^*)).$$

After combining the properties of marginal returns and marginal disutility, the following proposition characterizes the major feature of the equilibrium path of both parties' actions.

Proposition 3.3. *The optimal level of auditing effort and earning management decreases over time.*

Let us explain the intuition of this result for the auditor case. As long as the auditor's career elapses -the manager's career *ceteris paribus*-, his auditing effort exhibits a *decreasing* (present value of) marginal return and an *increasing* marginal disutility. Since only the incremental disutility depends on effort, the only way to maintain the marginal condition of optimality is by means of decreasing auditing actions. Notice that it is crucial for the auditor exert less effort over time since his incentives to build a reputation also decline. In fact, the learning process on the precision of his ability described by expression (2.9) means that the uncertainty about the auditing ability, $1/k_t$, goes to zero. As a consequence, the implicit incentives provided by futures opportunities for the auditor are dissipated over time and thereby, auditing actions become useless.

It is important to point out that this analysis is true for a given level of optimal announced earnings x_t^* , that is, assuming that the manager's career is fixed. Nevertheless, as Proposition 3.3 establishes, when $t \rightarrow \infty$ for the manager, earning management actions a_t^* also go to zero. Accordingly, the optimal signal x_t^* *declines* in a stochastic sense because. Note that the assumption $\psi_{ex}(\cdot) < 0$ guarantees that the marginal disutility function to the auditing effort *shifts in* when $t \rightarrow \infty$ for the manager. Thus, this also drives the level of optimal auditing effort to zero even in cases in which the auditor be in early stages of his career and his marginal return be far away from zero. All this implies directly the following result.

Corollary 3.4. *For a given level of prospective opportunities for the audit, he will spent lower effort when he faces a manager with lower career concerns incentives.*

Proposition 3.3 also states that financial statement manipulations decrease over time as the incentives to build a reputation for the manager decline as well. Again, these implicit incentives disappear because of the uncertainty about the managerial ability vanishes as the manager's career passes. According to (2.1), this induces stochastically a smaller x_t^* over time, which, as we discussed above, has effects on auditing effort decisions.

Furthermore, we can observe from the marginal optimality conditions of the auditor's problem that when $t \rightarrow \infty$, and for a given level of optimal signal x_t^* , the optimal auditing effort e_t^* goes to zero. The assumption $g_{ae}(\cdot) > 0$ implies that the marginal disutility function to the managerial action *shifts out* when $t \rightarrow \infty$ for the auditor, which increases the level of optimal earning management. This suggests that a contractual relationship with an auditor with low career concerns could offset the lack of incentives by the manager to manipulate financial statements when he is at the last stages of his career and the marginal return to these actions is small. The next result follows then directly.

Corollary 3.5. *For a given level of prospective opportunities for the manager, he will follow higher earning management actions when he faces an auditor with lower career concerns incentives.*

4 Concluding Remarks

This paper characterizes the contractual relationship between an auditor and a client firm's manager when the incentives for both parties are implicit as in the career concerns literature. Our results are twofold. First, earning management and auditing effort are decreasing over time as the present value of the marginal return to these actions is also decreasing, and thus, incentives to build a reputation decline for both agents. Second, as a result of a strategic interaction between the auditor and the manager through their disutility functions, the actions undertaken by each agent in a given period are additionally influenced by the current actions or signals chosen by his counterpart.

As a consequence, the combination of these two findings suggests that the effort exerted by each agent will depend not only on the incentives provided by his own career concerns, but also on the implicit incentives of his counterpart. This implies, on the one hand, that audit effort in a given period should be higher when the auditor is an emerging firm and/or the future employment opportunities for the client firm's manager are larger. On the other hand, one should expect that earning management actions be higher as long as the prospective opportunities for the manager are larger and/or the auditor is an older firm in the market.

Two key underlying assumptions allow these results to emerge. First, we suppose that market's learning processes of both managerial talent and auditor ability are so that uncertainty about these abilities vanishes over time. Hence, the usefulness of actions undertaken and signals disclosed by agents is also dissipated. Second, we model the manager-auditor relationship in each period as a sequential game in which

the strategic interaction is provided through the effort's disutility functions of both agents. Thus, the assumptions made in connection with the cross-effects of actions and signals on the marginal disutilities are crucial to obtain the second result.

All this suggests some extensions that could jeopardize the robustness of the conclusions attained here. The first one is the inclusion of a learning process in which ability follows a noisy process and thus, varies over time. Since this additional noise prevents that ability can be known with full precision, the sequence of optimal efforts could not be necessarily decreasing over time. The second avenue of extensions is modelling the manager-auditor relationship under other frameworks, either by modifying the nature and timing of the game played between both agents or by considering other strategic interaction links between them.

Finally, a third line of future research is to take into account different types of auditing efforts. This extension is especially relevant if one considers that in practice audit testing is typically categorized according to the type of risk that auditor faces: inherent risk, control risk and detection risk. In this sense, the extension of our model to a multi-task career concerns environment à la Dewatripont, Jewitt and Tirole (1999) seems pertinent. This could be a good starting point for examining how any complementarity and substitutability between these three class of auditing activities could affect the strength of implicit incentives.

5 Appendix

Proof of Proposition 3.1. Substituting the solution $\{a_t^*(x^{t-1}, r^{t-1})\}_{t=1}^\infty$ of the Manager's Problem into the accounting earnings process given by (2.1), we obtain the sequence of optimal random signals $\{x_t^*\}_{t=1}^\infty$. Then, incorporating this sequence in the reaction function $e_t(\cdot)$ described by (3.2), we get the sequence of non-stochastic optimal auditing efforts $\{e_t^*(r^{t-1}, x_t^*)\}_{t=1}^\infty$. Similarly, after substituting the last sequence into the audit earnings report process described by (2.3), the sequence of optimal random reports $\{r_t^*\}_{t=1}^\infty$ is attained. Next, plugging sequences a_t^* and x_t^* into (2.5) allows us to get the conditional expectations of θ . A similar substitution of e_t^* and r_t^* into (2.8) yields the conditional expectation of ϕ . Finally, replacing all of these previous sequences into constraints (3.2) and (3.4) allows us to find the vector of salary sequences $\{w_t^*, \tau_t^*\}_{t=1}^\infty$. \square

Proof of Lemma 3.2. From (3.8), let us define ζ_t , the present value of the marginal return to auditing effort at period t , as follows

$$\zeta_t = \sum_{s=t}^{\infty} \delta^{s-t} \beta_s, \quad \forall t = 1, 2, \dots \quad (5.1)$$

Similarly, using (3.9), define γ_t , the present value of the marginal return to earning management at period t , as

$$\gamma_t = \sum_{s=t}^{\infty} \delta^{s-t} \alpha_s, \quad \forall t = 1, 2, \dots \quad (5.2)$$

Given the learning processes about the precision h_t and k_t described by expressions (2.6) and (2.9), both sequences β_t and α_t converge to zero as $t \rightarrow \infty$. Hence, and since $\delta < 1$, ζ_t and γ_t decline in turn to zero as $t \rightarrow \infty$, which completes the proof. \square

Proof of Proposition 3.3. First, the first-order condition to the auditor's problem, evaluated at the equilibrium path, is given by

$$\zeta_t = \sum_{s=t}^{\infty} \delta^{s-t} \beta_s = \Psi(e_t^*, x_t^*) \quad \forall t = 1, 2, \dots$$

From Lemma 3.2, ζ_t is a declining sequence as $t \rightarrow \infty$. Moreover, the function $\Psi(\cdot)$ is increasing in e_t as, by assumption, $\psi(\cdot)$ is a convex function in e_t . This implies that for a given level of optimal announced earnings x_t^* , the equilibrium level of auditing effort decreases over time.

Second, the first-order condition to the manager's problem, evaluated at the equilibrium path, corresponds to

$$\gamma_t = \sum_{s=t}^{\infty} \delta^{s-t} \alpha_s = g'_a(a_t^*, e_t^*(x_t^*)) \quad \forall t = 1, 2, \dots \quad (5.3)$$

Lemma 3.2 implies that γ_t is a declining sequence as $t \rightarrow \infty$ for the manager. Finally, the convexity of the function $g(\cdot)$ with respect to a_t ensures that, for a given level of auditing effort, the optimal level of earnings management a_t^* decreases over time. \square

6 References

- ANTLE, R. (1984): Auditor Independence, *Journal of Accounting Research*, 22, 1-20.
- DEGROOT, M.H. (1970): *Optimal Statistical Decisions*, New York: McGraw-Hill.
- DEWATRIPONT, M., I. JEWITT, AND J. TIROLE (1999): The Economics of Career Concerns, Part II: Application to Missions and Accountability of Government Agencies, *The Review of Economic Studies*, 66(1), 199-217.
- FAMA, M. (1980): Agency Problems and the Theory of the Firm, *Journal of Political Economy*, 88, 288-307.
- FIRTH, M. A. (1997): The Provision of Nonaudit Services and the Pricing of Audit Fees, *Journal of Business Finance and Accounting*, 24, 511-525.

HOLMSTROM, B. (1999): Managerial Incentive Problems: A Dynamic Perspective, *Review of Economic Studies*, 66(1), 169-182.

MEYER, M., AND J. VICKERS (1997): Performance Comparisons and Dynamic Incentives, *Journal of Political Economy*, 105(3), 547-581.

RUIZ-BARBADILLO, E., N. GOMEZ AGUILAR, AND N. CARRERA PENA (2006): Evidencia Empírica sobre el Efecto de la Duración del Contrato en la Calidad de la Auditoría: Análisis de las Medidas de Retención y Rotación Obligatoria de Auditores, *Investigaciones Económicas*, 30, 283-316.

SIMUNIC, D.A. (1984). Auditing, Consulting and Auditor Independence, *Journal of Accounting Research*, 22, 679-702.

SONG, F., AND A. THAKOR (2006): Information Control, Career Concerns, and Corporate Governance, *Journal of Finance*, 61(4), 1845-1896.